THE
AMERICAN
SURGEON

Subscription in the United States, $8.00

Vol. XVII, No. 4 April, 1951

ARGUMENT FOR RADICALISM IN CANCER SURGERY

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DURING the past half-century, the evolution of cancer surgery has progressed from limited excision of the malignant tumor to total removal of the organ involved and finally even to an evisceration or exenteration of adjacent organs and tissues. The purpose of the surgeon to divorce the patient from his cancer appears to be limited solely by the ability of the human remnant to survive. More and more organs, though known to be useful to the economy and well-being of the individual, have been shown to be unessential for life and so have been added to the group suitable for sacrifice. At first, these more radical operations were the weapons of a few intrepid surgeons, but with improvements in anesthesia, pre- and postoperative care, blood replacement, chemotherapy, and the resident training of young surgeons, the extension of radical surgery in the treatment of cancer has found increasing acceptance throughout this country. The situation has become almost a national contest, but a useful consequence has been an improvement in operative technic, a lowering of mortality rates and a more rapid evaluation of these procedures.

In taking stock we should never champion a principle of treatment without consideration of the individual patient for whom it is intended. Is the indication for the radical mutilating operation a pride in one's technical capability or an actual need by the patient? Is it the principle or the necessity which dictates the choice of

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Presented during the Washington Assembly of The Southeastern Surgical Congress, Washington, D. C., March 6-9, 1950.

operation? Shall it be a routine or an elective procedure? Is the human residue happy?

Of course, many operations designed and attempted as curative accomplish only a palliative end result. The proper measure of palliation is not the length of postoperative life, but the degree of comfortable existence. Unfortunately there is no yardstick to record the value of the many radical operations for the short term survivors. One may justifiably and ruthlessly remove multiple organs if the patient thereby is given a reasonable prospect of cure or a shorter life worth living. On the contrary, one of our patients with leucoplakia of oral cavity, pharynx, larynx and esophagus, developed multicentric cancers and at intervals of years underwent glossectomy, total laryngectomy and finally esophagectomy. It was a surgical triumph, even though he couldn't talk, masticate or swallow. He committed suicide.

I have no intention of an all-inclusive recital of the scope of radical cancer surgery, but wish solely to review the tendency in this direction, pertaining to cancers of certain regions and histologic types.

Cancer of the Larynx. In early years, the surgical treatment of laryngeal cancers was limited to such conservative operations as tracheostomy, laryngofissure, partial laryngectomy and simple total laryngectomy. Now, if the cancer invades beyond the organ or metastasizes, a single stage radical operation is commonly performed, such as total laryngectomy, plus cervical esophagectomy or total laryngectomy with radical neck dissection.

Oral Cancer Metastatic to Cervical Nodes. The time may be past for the independent conservative management of major intraoral cancers and later secondary neck dissections. The present trend is to treat cancers of the tongue, floor of mouth, cheek, inferior alveolus and lip by a combined operation of neck dissection, mandibulectomy, excision of cheek, alveolus, floor of mouth and even glossectomy in a single operative seance. This formidable procedure, known facetiously as the "Commando" operation, embodies the principle of "excision and dissection in continuity for primary and metastic cancer" because it removes the intervening lymphatics and their tiny intercalated lymph nodes.

Mammary Cancer. Although a half-century has elapsed since Halsted and Willy Meyer independently conceived the principle underlying radical mastectomy, few innovations or improvements have been introduced until recent years. Halsted's attempts at supraclavicular dissection have been renewed and with transsection

of the clavicle and resection of the first rib they may extend the scope of radical dissection. Interscapulo-thoracic amputations and lower neck dissections are done for fixed, bulky, axillary metastases associated with lymphedema and dysfunction of the arm. Inasmuch as the opposite or apparently normal breast becomes involved by an independent primary cancer in about 6 per cent of cases, it is time to consider the feasibility of routine bilateral mastectomy (radical for the implicated breast, simple for the contralateral breast) as a single operation through a transverse incision, thereby permitting a wider sacrifice of skin without handicapping wound closure. Certain intelligent patients have requested this operation, but it should be presented to them as a routine rather than elective procedure.

Excision and Dissection in Continuity for Epitheliomas and Melanomas of the Skin. Malignant melanomas and epidermoid carcinomas developing in skin within the neighborhood of regional nodes involved or most likely to be involved by metastases are now treated by the principle of excision and dissection in continuity, a procedure which implies a wide sacrifice of skin surrounding the primary lesion and continuance of the skin excision to include subcutaneous tissues and fascia and intervening lymphatics between the primary lesion and the regional nodes, and a radical dissection of these nodes, the entire process being removed en masse. The universal adoption of this principle of treatment for all skin cancers metastasizing by way of the lymphatics promises a higher percentage of five-year survivals. If this discontinuous operation should not be performed, separate incisions made for primary cancers and regional node dissections with preservation of intervening lymphatics invariably fail because of the common recurrence of the cancers in small lymph nodes intercalated in these lymphatic pathways.

Level of Amputation for Lymphatic Metastasizing Tumors of Hands and Feet. Malignant melanomas or epidermoid carcinomas of hands and feet that remain localized are treated by surgical excision and skin grafting or partial amputation as the case may be. In the absence of demonstrable evidence of metastases to lymph nodes, no elective dissections are performed, but the patients are kept under constant observation. If proved metastases do occur in the groin or axillary nodes then a hip joint disarticulation with deep iliac lymph node dissection or an interscapulo-thoracic amputation with lower neck dissection respectively are routinely done. No surgeon has ever reported a significantly large group of patients treated by the more conservative procedure of local operations for malignant tumors of the hands and feet with independent axillary and groin dissections in which more than a token of five-year cures has

been obtained. The independent and disparate operations for metastasizing melanomas and epidermoid carcinomas of the hands and feet almost invariably result in fatal outcomes with metastases developing in the intervening lymphatic networks of the extremity.

Hemipelvectomy and Interscapulo-Thoracic Amputation. In the Memorial Hospital there have been 23 hemipelvectomies and 77 interscapulo-thoracic amputations without an operative death. Disarticulation of the humerus at the shoulder joint is never indicated for cancer, inasmuch as the residual shoulder serves no useful purpose; the higher operation with removal of clavicle and scapula and cervical lymph nodes permits excision rather than dissection of the axilla, affords a greater margin of normal tissues intervening above the superior limit of the cancer and results in no greater functional handicap. The inter-ilio-abdominal amputation (sacro-iliac disarticulation) now safely performed is an almost bloodless operation and presents a new avenue for the cure of chondrosarcomas and other malignant tumors of the bony pelvis, sarcomas of the soft somatic tissues involving the upper thigh, buttocks and groin and metastasizing tumors involving the iliac nodes, adherent and unsuitable for dissection.

Cancer of the Esophagus. Esophagectomy with intrathoracic esophagogastrostomy has been performed with increasing frequency for cancers of the esophagus and gastric cardia. Four contributing factors have facilitated the extension of radical esophageal surgery:

1. Awareness of the common tendency of the esophageal cancer to extend in a longitudinal direction for remarkable distances above and below the palpable limits of the tumor.

2. Recognition of the necessity for a three-dimensional dissection of the mediastinum because of the invasive character of many esophageal cancers with early perforation of the esophageal wall and infiltration of neighboring structures.

3. Acceptance of the advantages of esophagectomy through the right thoracic approach in which the esophagus is not traversed by the aortic arch, the procedure being facilitated by a previous mobilization of the stomach through a laparotomy without severance of the diaphragm. In the right chest the esophagus is exposed throughout its entire length and dissection is more often accomplished.

4. Demonstration of the possibility that the stomach with intact blood supply can be pulled through the chest into the neck for high anastomosis with the cervical esophagus or pharynx.

Gastric Cancer. In earlier years the scope of gastrectomy for cancer and ulcer were practically identical. Gastrectomy for cancer

has only recently been properly standardized with general recognition of the principles necessary for a curative effort, namely, an adequate margin of duodenum and stomach distal and proximal to the cancer, routine removal of the great omentum, dissection of all perigastric lymph nodes notably along the lesser curvature, and resection of adjacent organs involved by contiguity, namely the transverse colon, mesocolon, spleen, tail and body of the pancreas, left hepatic lobe and so forth. Total gastrectomy by the abdominal route and esophagogastrectomy by laparothoracotomy increase the percentage of resectability and enlarge the opportunity for cures. Total gastrectomy is replacing partial gastrectomy for diffuse carcinomas of the stomach or those with extensive metastases in perigastric nodes. The frequency of local recurrence after subtotal gastrectomy is an added incentive in the argument for the total ablation of the organ, and mortality for total gastrectomy is encouragingly low in large surgical centers. In due course of time, total gastrectomy might supplant partial resection for all gastric cancers. Gastric cancers which implicate the adjacent viscera by contiguous growth are not inoperable in the majority of instances, although their extirpation may require removal of the spleen, colon, pancreas and left hepatic lobe.

Pancreatic Cancer. Subtotal pancreatectomy, duodenectomy, pylorectomy and pancreaticojejunostomy, choledochojejunostomy and gastrojejunostomy has proved to be a successful operation for cancers of the ampulla of Vater, but has been a dismal failure for cancers of the pancreas proper, if the results are measured by curability only. Two avenues of improvement are the adoption of total pancreatectomy with node dissection and excision of the superior mesenteric vein with a substituted blood vessel graft. Although ligation of this vein in dogs has been tolerated, in humans it has been followed in our bitter experience by mesenteric thrombosis, intestinal gangrene and death. The one great handicap in performing pancreatectomies has been the involvement of or adherence to the vein by the cancer.

Cancer of the Colon. An increasing number of patients with cancer of the colon and rectum subsequently develop a new primary cancer requiring secondary resection. This is particularly true in the presence of polyposis. Total colectomy with ileoproctostomy is no longer a rare operative procedure and may be done in a single operative seance. The higher rate of curability of cancers of the right colon and cecum over cancers of the descending and sigmoid colon, conceivably may be due to the necessity (because of its single arterial source) of performing an entire right hemicolectomy and

its consequent radical removal of the lymph drainage system; a left hemicolectomy planned to remove the entire descending colon and splenic flexure with anastomosis of the transverse to sigmoid colon may ultimately supplant the more conservative excision and anastomosis which has been previously practiced. An original, logical and promising innovation from Owen Wangensteen has been a secondary operation called a "clean-up" procedure or "second look" to be performed several months later in patients who had resectable gastrointestinal cancers with proved metastases in regional nodes. At the second operation, inspection is made for the presence of other suspiciously enlarged lymph nodes which would then be dissected. Such a procedure is the only way in which a proper check-up observation can be performed for cancers of this location and extent.

Cancer of the Rectum. The classical abdominoperineal rectal resection of Miles has been employed for 46 years without appreciable modification. A recent more radical innovation has been the addition of iliac and obturator node dissections in continuity with the rectum. Bilateral oophorectomy may be added as a supplementary measure because of the frequent later development of metastatic foci in the ovary of the usual rectal cancer or those of the Krukenberg type. A strange paradox exists in my indications for conservation of the sphincter in operations for rectal cancer, in that this conservatism is practiced only for the very early cancers that seem to be unquestionably curable (highly situated, polypoid, noninvasive, circumscribed, small and of low grade malignancy) and conversely, for the hopeless or incurable case in which a rectal resection followed by a low anastomosis is judged to offer better palliation than a colostomy for the short life expectancy.

Epitheliomas and Melanomas of the Anus. Many superficial epitheliomas of the anus are cured by well-planned radiation therapy. Epitheliomas metastasizing to regional nodes and all malignant melanomas of the anal canal require a most radical plan of treatment. Such a plan involves an abdominoperineal rectal resection with intra-abdominal bilateral iliac and obturator lymph node dissections, a wide sacrifice of perianal tissues in continuity with bilateral inguinal and femoral node dissections.

Malignant Tumors of the Vulva. Epitheliomas of the vulva are so frequently multicentric and develop so often on precancerous lesions that conservative excisions should be finally abandoned in favor of radical vulvectomy with bilateral groin dissection, performed in one stage. The indications for radicalism are even stronger for malignant melanoma of the vulva. The outer vaginal third is usually removed with the vulva and inguinal lymph nodes.

Pelvic Visceral Exenteration. Radical total cystectomy with uretero-sigmoid implantations and bilateral nodal dissections, radical panhysterectomy with excision of the broad ligaments, iliac and obturator nodal dissections and partial vaginectomy have increased the cure rate for cancers of the urinary bladder, uterine cervix and endometrium. For an advanced cancer of the body of the uterus there is an increasing consideration for the necessity of adding vaginectomies to the orthodox radical procedure in view of the often demonstrated tendency of these cancers to metastasize in a retrograde fashion via the lymphatics into the vagina as far down as the vaginal orifice. Vaginal cancers which were previously considered inoperable by gynecologists because of invasion of the bladder base or recto-vaginal septum are now treated by radical surgical extirpation which in some instances requires abdomino-perineal rectal resection with hysterectomy, vaginectomy and even total cystectomy and vulvectomy depending on the extent and invasiveness of the cancer. Cancers of the uterine cervix which are notoriously prone to invade the rectum and bladder sometimes with the formation of multiple fistulous communications and with local metastases in the pelvis, are amenable to radical pelvic evisceration. The necessity of the individual case may require a panhysterectomy, pelvic lymph node dissection and either total cystectomy with proper disposition of the ureters or conjoined abdominoperineal rectal resection depending on whether the route of invasion is toward the bladder or rectum, respectively. In the extreme cases, urinary bladder, uterus, vagina and rectum are excised en masse. As to the disposition of the ureters under these circumstances, considerable argument exists as to the wisdom of implanting them in the colon proximal to the colostomy which therefore becomes constantly wet or to construct independent skin ureterostomies with a dry colostomy, a lower operative mortality, and less morbidity referable to kidney function. If total cystectomy and panhysterectomy are done with preservation of the rectum, uretero-intestinal anastomoses are always performed, because a continent rectal sphincter is present.

Removal of Visceral Metastases in Lungs, Liver and Brain. Ten years ago a pulmonary lobectomy, partial hepatectomy, or craniotomy for the removal of metastatic cancer would have been condemned as futile and indicative of bad surgical judgment. With the primary cancer controlled and in the absence of generalization of the disease, these operations are occasionally done as a measure to increase the duration and extent of palliation. One 11 year old patient of ours with thyroid cancer is now living and well 18 years after a craniotomy and removal of a single focus of thyroid cancer in the choroid plexus. Excision of metastatic melanoma in the liver

secondary to melanoma of the eye has convinced us that it is not a useless procedure in view of the phenomenal latent period that may exist between the date of enucleation of the eye and the appearance of hepatic metastases: sometimes a period of several years. The unknown inhibiting factors responsible for this delay encourages the surgeon to attempt such radical operations.

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THE CLINICAL ASPECTS OF HEMATEMESIS

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This study, dealing with the various aspects of hematemesis, is based on 75 case histories from Crawford W. Long Hospital from May, 1947, through September, 1949 (28 months). Those patients exhibiting melena alone, without associated hematemesis, are excluded from the analysis. The degree of severity of the hemorrhage is in each case determined by the red blood count obtained on admission to the hospital. It may be observed from Table 1 that massive hemorrhage occurs when the red blood count is less than 3,000,000, while a red blood count of between 3,000,000 and 4,000,000 denotes a moderate degree of hemorrhage. The bleeding is considered to be of slight degree if the admission red blood count is 4,000,000 or greater.

TABLE 1

Degree of Hemorrhage

	Red Blood Count	*No. Pts.*	*% Pts.*
Massive	3,000,000 or less	27	36.0
Moderate	3 - 4,000,000	33	44.0
Slight	4,000,000 or more	15	20.0
Total		75	100.0

It is evident that of the 75 patients exhibiting hematemesis, 36 per cent of them had experienced massive hemorrhage, 44 per cent moderate hemorrhage, and 20 per cent slight hemorrhage. The average red blood count for all 75 cases was 3,200,000 with the corresponding hemoglobin value being 9.7 Gm., or 62.9 per cent. The lowest red blood count recorded at the time of admission to the hospital was 1,700,000 (2.7 Gm., or 17 per cent Hb.) which occurred, as may be expected, in a patient having a massive degree of hemorrhage. The average white blood count for all patients was 11,066.

Incidence

Age. The oldest patient experiencing any degree of hematemesis was 84 years of age, while the youngest was 6. The average age of those patients experiencing a massive degree of hemorrhage was 56 years, those having moderate hemorrhage 48 years, and those with

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only slight bleeding 42 years of age. The average age of all patients was 47.8 years. The various age groups in which hematemesis occurred most frequently were those patients ranging from 30 to 49 years of age, which was true both within the entire group and also within the various sub-groups (massive, moderate or slight). In general, the older patients (40 to 79 years) experienced the more severe degrees of bleeding, while slight bleeding occurred in the younger age groups (20 to 49 years).

Sex. Fifty-four of the 75 patients were males (72 per cent), while 21 were females (28 per cent), resulting in a male:female ratio of 2.5 to 1, respectively. Females were found to suffer more frequently from the more massive bleeding episodes than were males, and conversely more males experienced slight degrees of hemorrhage than did females.

History

The duration of bleeding in approximately 84 per cent of the patients occurred up to 72 hours of the time of admission to the hospital, the average length of time being 13 hours. In the patients having symptoms of bleeding for more than 72 hours, the average length of time was 10 days, and in these patients 50 per cent were found to be severely anemic. Approximately 91 per cent of the 75 patients included in this series exhibited hematemesis as their chief complaint on admission, while the remainder developed it at some time during their hospital stay. The incidence of hematemesis was found to be essentially of the same degree within mild, moderate and severe groups. Seventy-three per cent of the patients also presented melena as an associated complaint on admission, and although 16 per cent had no apparent melena at that time, it almost invariably appeared at some time during the hospitalization period. In distinct contrast to the general average of 73 per cent, and especially to that of the individual groups, 93 per cent of the massively bleeding patients had accompanying melena, while only 70 per cent of the intermediate group and 47 per cent of those bleeding slightly had associated melena. Also only 3 per cent of the massively bleeding patients did not have coexisting melena, while 47 per cent of the slightly bleeding group failed to have melena on admission. Of the total number of 75 patients, only 33 per cent had accompanying abdominal pain, either at the onset or during the episode of bleeding. The group consisting of the massive bleeders had pain in 48 per cent of their cases, while painless bleeding occurred in 25 per cent of this group.

In reviewing the past histories of these patients, it was noted that 23 per cent of all patients had had previous episodes of hemate-

mesis prior to the present one, while in 56 per cent the bleeding episode was the first experienced by the patient. There was little appreciable difference between the individual groups and the total in this respect. The instances of previous bouts of hematemesis in 17 patients ranged from 1 to 10, with the average being 2.4. Over two-thirds of the patients were known either to have at the present time or to have had peptic ulcers. Fifty-six per cent of the massive group may be placed in this category, while 80 per cent of those with slight bleeding may.

The diagnosis of a previously existing ulcer was stated to have been made following a gastrointestinal series in 17.7 per cent of these patients, by a suitable history of the ulcer diathesis in 78.4 per cent, and following operative intervention in 3.9 per cent. The average patient had had an ulcer for 8.6 years, with the longest duration being 22 years and the shortest only one month. Of 6 patients having undergone surgery previously for severe complications of peptic ulcer (8 per cent), 3 were in the massively bleeding group, 2 in the moderately bleeding group, and 1 in the slightly bleeding group. Two of the patients had undergone two operative procedures each. The indication for the previous operation in 4 patients was perforation of the ulcer, for hemorrhage in 1, and in one instance the reason was not stated. Only one subtotal gastrectomy had been performed while five perforations were closed. The operative procedure had been performed on an average of 4.9 years prior to the present admission, with the longest time interval being 11 years and the shortest six weeks.

Physical Findings

The physical findings were of interest, but were not considered to have particular diagnostic importance in determining the etiology of the lesion causing the hemorrhagic episode, with the exception that bleeding esophageal varices resulting from portal hypertension could usually be excluded. The presence of abdominal distention was noted in only 5 per cent of the total number of patients, 45 per cent were observed to have epigastric tenderness, while in 40 per cent no tenderness was elicited. The average temperature on admission was 98.9 F., pulse rate 96, and blood pressure 113/73. There was no significant variation as regards these findings within the slight, moderate or massive groups of patients.

Etiology

The bleeding sites responsible for the various episodes of hematemesis in this group of patients may be noted in Table 2. Duodenal ulceration accounted for 48 per cent of the hemorrhagic episodes,

followed in succession by gastric ulcer (5.4 per cent), marginal ulcer (4.0 per cent), ruptured gastric varices, secondary to portal hypertension from a primary adenocarcinoma of the left hepatic duct (1.3 per cent) and adenocarcinoma of the stomach, arising in a chronic gastric ulcer (1.3 per cent). The relative frequency of these pathologic lesions is essentially the same within the three groups. Forty per cent of the cases were undiagnosed at the time of discharge from the hospital, due mainly to the fact that no attempt was made to obtain barium studies of the upper gastrointestinal tract during the period of hospitalization. If gastric, duodenal and marginal ulcers are considered jointly as peptic ulcers, the occurrence of this particular lesion is found to account for well over half (57.4 per cent) of the episodes of hematemesis.

TABLE 2

Bleeding Site

	No. Pts.	*% Pts.*
Gastric Varices	1	1.3
Gastric Ulcer	4	5.4
Gastric Carcinoma	1	1.3
Duodenal Ulcer	36	48.0
Marginal Ulcer	3	4.0
Undiagnosed	30	40.0
Total	75	100.0

Diagnosis

Forty-four per cent of the lesions were diagnosed on the basis of x-ray findings following gastrointestinal series, 8 per cent by autopsy, 4 per cent by operation and 4 per cent by the clinical history (marginal ulcers only). The final diagnosis of marginal ulcer is only strongly presumptive, since gastrointestinal series were not performed in those patients, but nevertheless is apt to be the most likely cause of the hemorrhage in those patients who give a bona fide history of having previously undergone a gastric anastomosis. Forty per cent of the lesions were undiagnosed. This particular group was usually considered to have a "peptic ulcer" causing the bleeding, on the basis of the clinical picture alone, but apparently this diagnosis was not fully substantiated by definite diagnostic procedures.

Of 39 patients undergoing a gastrointestinal series, usually about 10 days following cessation of bleeding, a positive diagnosis was established in 31 patients, or 79 per cent. Eight, or 20.5 per cent,

were reported as showing no abnormality in the upper gastrointestinal tract. Of these 31 patients, all proved to have duodenal ulcer except 1 who had a pyloric lesion. Of the group having x-ray findings, 1 patient had had two such examinations. Another with a duodenal ulcer was found to have incidentally a small hiatus hernia, which was thought to be asymptomatic at the time. However, 1 patient noted to have spasticity of the duodenal bulb, in the absence of any specific demonstrable organic lesion, was ultimately proved at autopsy to have an adenocarcinoma of the stomach.

Treatment

The immediate form of treatment usually instituted consisted of bed rest, appropriate sedation, and transfusions with whole blood. In only a few instances was plasma administered instead of blood, while 10 patients received no blood during their period of hospitalization. The average amount of blood administered to the remaining 65 patients was 1,845 cc., while the largest total amount received by any individual was 7,500 cc. The usual dietary regime consisted initially of a sippy diet (30 patients), while 16 patients were placed on no oral intake of any sort during the first 24 hours (reduced to 4 patients during the second 24 hours), and only ice or water was allowed 16 patients. In only 3 patients was continuous gastric suction employed, and in none was there evidence that this method resulted in either further or in recurrent bleeding.

Of 4 of the 75 patients undergoing surgical intervention (5.3 per cent), in only 1 of them was the procedure performed as the initial emergency form of treatment (12 hours following admission). This patient was found to have an extensive adenocarcinoma of the stomach with gross metastases to the pancreas and gastrocolic ligament, and despite the administration of 3,500 cc. of citrated blood during and immediately following the operation, expired 20 hours later of irreversible shock. Three of the patients had duodenal ulcers, averaged 42 years of age, enjoyed an uneventful convalescence, and were discharged on an average of 8 to 10 days following operation.

Hospital Course

Following admission to the hospital, 46.7 per cent of the 75 patients experienced subsequent episodes of hematemesis, with those patients in the moderately bleeding group suffering slightly more such episodes than those in the massively or slightly bleeding groups. Thus, it is apparent that although the patient with hematemesis on admission may at that time be considered to be bleeding

TABLE 3

Hospital Deaths

Age	*Sex*	*Group*	*Duration Symptoms (Hours)*	*Previous Episodes*	*Known Ulcer*	*Bleeding Site*	*Treatment*	*No. Hem.*	*Cause Death*	*Day Death*
84	M	Moderate	48	0	0	Unknown	Medical	3	Hemorrhage	2
43	F	Massive	24	0	0	Unknown	Medical	7	Hemorrhage Uremia	3
43	M	Massive	30	Unknown	+	Duodenal Ulcer	Medical	1	Hemorrhage	4
65	M	Massive	24	Unknown	Unknown	Duodenal Ulcer	Medical	3	Hemorrhage myocardial infarction	3
42	F	Massive	12	0	0	Carcinoma Stomach	Surgical	3	Hemorrhage	1
45	M	Moderate	48	Unknown	+	Gastric Varices	Medical	3	Hemorrhage	2
75	M	Moderate	6	0	0	Gastric Ulcer	Medical	1	Hemorrhage	5
64	F	Moderate	24	0	+	Unknown	Medical	19	Hemorrhage	5
78	M	Massive	48	0	0	Gastric Ulcer	Medical	0	Hemorrhage Myocardial Failure	1

only moderately, he may well progress to the state denoting massive blood loss within a short period of time.

The number of individual episodes of hematemesis varied from 1 to 19 or more (average 2.7). Nearly all patients exhibited subsequent melena after two to three days time, and it is interesting to note that of 4 patients not included in this study, all had actively bleeding peptic ulcer, but presented melena only as their initial complaint, and at no time during hospitalization did hematemesis occur. The average duration of hospitalization for all patients was 8.9 days, and did not vary sufficiently between the various groups to be significant. The shortest period was two days and the longest 30. Sixty-four patients, stabilized within 24 hours, 1 in 28 hours, and 1 after five days, as was manifested by cessation of hematemesis and by return of the pulse and blood pressure to normal limits. Serious associated diseases were arteriosclerosis (8), hypertension (3), nephritis (1), and uremia (1). Eight patients were chronic alcoholics.

Mortality

Nine of the 75 patients included in the study expired during their hospitalization (Table 3), which results in an over-all mortality rate of 12 per cent for the series in general. Eight of these received only conservative management, while 1 underwent operative intervention. Of the 8 receiving only conservative therapy, the mortality rate was 11.3 per cent among 71 patients, while 4 patients receiving surgical therapy experienced a mortality rate of 25 per cent (one death). All of the patients were over the age of 40, while two-thirds were over the age of 45. There were two duodenal ulcers, two gastric ulcers, one ruptured gastric varices, and one carcinoma of the stomach comprising the causative lesions. The bleeding site in 3 patients was not determined. The immediate cause of death in all cases was attributed to the effects of the hemorrhagic episode, although contributory factors in 3 patients were myocardial infarction, myocardial failure and uremia. Five patients were in the massively bleeding group, while the remaining 4 were in the moderately bleeding group and had either continued to bleed or else had recurrent bleeding, which fact has been noted previously as being not unlikely to occur. The terminal episode was also the first in 6 patients, while no data were available as to whether or not previous episodes of hematemesis had occurred in the remaining 3 patients. This illustrates the assertion by many authors that the first hemorrhage is apt to be the fatal one. Only 3 of the 9 patients were known to have had peptic ulcers prior to admission. Also from Table 3 it may be seen that all deaths occurred in those patients

whose hemorrhages were of short duration, the average period of time being 29.3 hours prior to admission. One of the patients expired 12 hours following a gastrointestinal series, but this procedure was not thought to have had any influence on the rate of bleeding. All patients but 1 had had repeated bouts of hematemesis while in the hospital, thus indicating that bleeding was still in progress, ranging from 1 to 19 episodes and averaging 4.7. The time of death following admission to the hospital varied from 24 hours to four days, averaging 69.6 hours or almost three days.

Discussion

The principal bleeding sites causing hematemesis in 75 patients at Crawford Long Hospital from May, 1947, through September, 1949, were found to be due to duodenal ulcers in 48 per cent of such instances, to gastric ulcer in 5.4 per cent, to marginal ulcer in 4 per cent, to bleeding gastric varices in 1.3 per cent, and to adenocarcinoma of the stomach in 1.3 per cent. In 40 per cent of instances, the site of bleeding was not determined. In a collective review of 758 similar such instances reported by four authors individually[1,2,3,4]. 59.7 per cent of the cases of hematemesis were due to duodenal ulcer, 11.9 per cent to gastritis, 8.3 per cent to gastric ulcer, 7.0 per cent to bleeding esophageal varices, 2.1 per cent to gastric carcinoma, 2.0 per cent to marginal ulcer, 0.7 per cent to hiatus hernia, and in 8.3 per cent the bleeding site was not determined. Although 40 per cent of the bleeding sites were undiagnosed in this series, as compared to 8.3 per cent of the collected series, this discrepancy is due to the fact that follow-ups of the patients in the series under discussion were not obtainable following their discharge from the hospital. However, it is reasonable to assume that most of them probably had diagnostic gastrointestinal series performed after leaving the hospital, the results of which are not known.

At Crawford W. Long Hospital, there were nine deaths among the 75 patients, resulting in an over-all mortality rate of 12 per cent. In those patients with peptic ulcer alone, 2 having duodenal ulcers died and 2 having gastric ulcers died, resulting in a mortality rate of 9.3 per cent among the 43 peptic ulcer patients. None of them were treated by emergency surgical intervention, and, therefore, represent the results of conservative therapy alone. In this connection the mortality rate in 12,759 patients with bleeding peptic ulcer collected from sixteen authors' experience averaged 10.1 per cent. The largest single group of conservatively treated patients is that reported by Meulengracht,[5] in whose series of 1,031 cases of bleeding peptic ulcer there were 26 deaths, yielding a mortality rate of 2.5 per cent. Of these patients undergoing early operation as the

sole method of treatment, Finsterer[6] reports a mortality rate of 3.6 per cent. Patients operated on later, however, suffered a mortality rate of 22.8 per cent, and of 301 cases reported by him as an example of operative management of the patient with bleeding peptic ulcer, the over-all mortality rate was 12.2 per cent. Of the 4 patients undergoing surgery at Crawford W. Long Hospital, 3 peptic ulcer patients were operated on approximately 10 days following cessation of the bleeding with no deaths. It is important to consider the fact that of the 24 massively bleeding peptic ulcer patients who were treated conservatively, the mortality rate following this method of management was 33.3 per cent (eight deaths). Therefore, it may be concluded that the mortality rate following conservative management does not range between 1 to 5 per cent, as is usually asserted, if the more severe cases are carefully analyzed separately and are distinguished from the series as a whole, many of which would survive without benefit of definitive treatment.

Summary

1. Of all patients entering the hospital primarily complaining of hematemesis, well over half will have bleeding peptic ulcers, and of them about 90 per cent will be due to duodenal ulceration.

2. Over one-third of such patients will show evidence of severe blood loss, as manifested by a red blood count of less than 3,000,000, a hemoglobin of less than 45 per cent (7.0 Gm.) and by varying degrees of shock.

3. Painless bleeding will occur in over 25 per cent of the patients, and in over one-half of them it will have been their initial episode.

4. Over two-thirds of the patients will have known peptic ulcers, and in the average patient it will have been present 8.6 years.

5. A satisfactory diagnosis as to the site of the hemorrhage may be obtained in at least 80 per cent of the patients following gastrointestinal series.

6. Immediate treatment should consist of absolute bed rest, appropriate sedation, immediate feeding, and by far the most important, adequate transfusions with whole blood.

7. The type of patient most apt to die of exsanguinating hemorrhage is the 45 year old patient with a chronic gastric ulcer, bleeding for the first time, and having some associated degenerative disease.

8. Since operation after 72 hours is attended by a prohibitive mortality rate, operative intervention should be undertaken in any patient over the age of 45 who either continues to bleed from 24 to

48 hours following admission to the hospital, or else who having stopped bleeding, recurs at any time.

9. The operation of choice should be an adequate subtotal gastrectomy with excision of the ulcer. If such a procedure is not feasible, as in a scarred posteriorly penetrating duodenal ulcer, some type of exclusion operation should be attempted.

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TRAUMATIC RUPTURE OF THE LIVER

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TRAUMATIC rupture of the liver is a serious condition that occurs more frequently than is generally realized. The amount of trauma required to produce liver disruption need not be exceptionally severe. Patients suffering from this condition may demonstrate little or no external evidence of abdominal or thoracic injury. The diagnosis is usually difficult to make, and statistics reveal a shockingly high mortality rate. Of vital importance in traumatic liver rupture is rapid evaluation of the patient combined with early surgical repair. Following a discussion of the important aspects in the diagnosis and management of these patients, we desire to present 4 cases, 3 of which were admitted within a 10 day period. All 4 demonstrated liver lacerations without involvement of other viscera.

That traumatic liver rupture is indeed a serious condition can be seen by a review of the following pertinent statistics. Madding, Lawrence and Kennedy[1] reported a 27 per cent mortality rate in a series of 829 World War II liver injury patients. This was a marked improvement over the 66.2 per cent mortality figures of World War I. Lamb[2] reported a 44 per cent mortality and Halberstam, Bloom and Graham[3] a 57.2 per cent death rate. Wright, Prigot and Hill[4] found 27 cases of subcutaneous liver rupture in 34,000 admissions to Harlem Hospital, an incidence of 1:1259. They found hepatic rupture more frequent than splenic rupture.

Various classifications of traumatic liver rupture include one by Moynihan[5] as follows: (1) rupture with capsule laceration. (2) separation of the capsule with subcapsular hemorrhage. (3) central rupture with abscess or cyst formation. It is an interesting fact that the amount of external violence required to produce hepatic rupture is not necessarily great. None of our patients gave evidence of severe injury to the chest or abdomen.

DIAGNOSIS

It is very difficult to make a diagnosis of liver rupture, especially so in the absence of a penetrating wound in that area. The consistent preoperative findings in our cases were: (1) history of external injury. (2) abdominal pain and distention. (3) abdominal tenderness and muscle spasm. (4) shock. (5) nausea. (6) dimin-

ishing red cell count and (7) leukocytosis. These symptoms and findings varied in degree but were always present. The above findings are definitely indicative of serious internal injury with hemorrhage.

The blood pressure in these cases is usually decreased especially if the hemorrhage has been of any appreciable amount. O'Neill[6] points to hemorrhagic shock as the reason for most clinical findings. He stresses the significance of right upper quadrant pain, tenderness, rigidity and shifting dullness. We did not note this last finding in our cases nor was the pain consistent in its location. Although 3 of our patients had a disruption of the convex surface of the right lobe, intrascapular pain was present in 1 case only.

In the presence of the above findings plus evidence of continued blood loss, it is essential to complete diagnostic measures rapidly for we are obviously dealing with a surgical emergency. Halberstam, et al[3] advocated early laparotomy when serial hematocrit determinations suggested repeated or continued hemorrhage. However, the bleeding may cease when the portal venous pressure is lowered sufficiently as noted by Madding, et al.[1] The bleeding had ceased in 91 per cent of their cases prior to operation. One must also bear in mind that patients often are not referred until hours or days after the initial injury. The "scout x-ray film" of the abdomen may be of definite diagnostic value.

Early exploration and operative repair is essential because of the importance of the liver in body function. Moreover, the combination of hemorrhage, necrotic liver tissue, bile in the abdominal cavity plus bacterial contamination make all liver lacerations surgical emergencies. The longer the operation is postponed the greater is the probability of bile peritonitis.

Operative Technic

In no other abdominal surgical condition is there greater necessity for adequate exposure of the operative field. The location of the liver within the thoracic cage and the absence of mobility of this organ necessitates a large transverse or oblique incision, depending upon the amount of costal flair. Adequate debridement is essential to remove fragmented liver and bile. Good basic surgical principles demand removal of accessible necrotic tissue. All detached liver tissue should be thoroughly removed from the traumatized bed.

In closing the liver we have routinely used deeply placed interrupted sutures of No. 1 chromic catgut with a large round needle. These are placed close together without tying, beginning at the an-

terior portion of the rupture. After two or three such sutures are placed, they can be used effectively as retractors so that the liver can be pulled downward to aid in placing the sutures in the posterior less exposed portions of the liver wound. Of tremendous aid in securing hemostasis is the use of one of the hemostatic strips such as Oxycel or Gelfoam which are placed along the wound edges before tying the sutures. After closure, suction is again used to cleanse the peritoneal gutters.

We can see many reasons for drainage and few against it. A review of the literature shows general agreement that drainage is necessary. Difference of opinion exists about the merits of the type of drain used. Both packs and rubber drains have been advocated. Madding, et al[1] seem to have settled this question. They report that while the use of drains rose from 48.5 per cent in 1944 to 87.4 per cent in 1945 and the use of packs dropped from 34.1 per cent to 9.0 per cent, there was a drop in mortality from 29.8 per cent to 16.9 per cent. The presence of necrotic tissue, blood and bile makes suppuration probable. In addition, one must consider the high degree of toxicity that results from a free piece of liver within the peritoneal cavity. Autolytic substances need a place to drain. Soft large Penrose drains are preferred. Two are placed beneath the dome of the right hemidiaphragm, one in Morrison's pouch, one in the right peritoneal gutter and one drain toward the pelvic gutter. All are brought out through the wound.

Through and through heavy silk sutures are used for closure whether or not layer closure is contemplated. We feel well satisfied with this type of closure and the wound appearance has always been good. These "tension" sutures are not removed for 10 days to two weeks, although there is no harm in leaving them for a longer period of time.

Preoperative and Postoperative Care

The vital importance of rapid yet careful examination and evaluation of all patients in whom there is any possibility of liver rupture must be stressed again and again. Acute blood loss may not be of immediate concern as the venous pressure in the liver is only 5-10 mm. of Hg. However, as Wright, et al[4] point out, there are several reasons for massive bleeding in liver cases, namely: 1. The hepatic veins have no valves with retractor power. 2. A mixture of blood and bile impairs clotting. 3. Respiratory movements aggravate bleeding. 4. Disrupted hepatic tissue acts as a poor tampon.

There should be time for proper typing and administration of blood preoperatively to replace any blood loss and to minimize

operative shock. Equally as important is the administration of blood following surgery. Transfusions should be continued for several days to replace protein and to aid wound repair and healing. Oxygen administration is an obvious need as operative shock and severe liver damage make for excessive oxygen demand.

Massive amounts of antibacterial agents are used because of inevitable bacterial contamination. Two million units of penicillin, four to six Gm. of sulfadiazine, and 600-1000 mgm. of aureomycin or chloromycetin daily are indicated. Prothrombin production is hampered by widespread hepatocellular damage. Oral feedings are started as soon as possible. A high protein and high carbohydrate diet is indicated for several weeks following surgery. Vitamins are used parenterally and orally in large amounts.

The drains are not disturbed for one week, at which time they are only loosened from the wound edges. Every other day one or two drains are shortened approximately an inch. Like the "tension" sutures, there is no harm in leaving them in for a longer period of time. Secondary hemorrhage as a result of rapid drain removal is an alarming possibility as shown in Case 3, even though the final drain was not removed until the twenty-fifth postoperative day.

All patients had hyperpyrexia postoperatively. Case 4 had evidence of some kidney damage as well. Massive amounts of separated liver tissue were found in this patient at operation.

Case Reports

Case 1. N. C., a 15 year old school girl, was admitted to Presbyterian Hospital. Two hours before admission she was thrown from a horse and struck the ground face down. She was temporarily stunned but almost immediately complained of severe cramping abdominal pain. Vomiting occurred on the way to the hospital.

Examination disclosed a pale, well nourished girl moaning with abdominal pain and lying with legs flexed. The skin was cool and moist. Temperature 98° F. The pulse was soft and the rate was 100 per minute. There were a few abrasions over the face, anterior chest, abdomen and thighs. No contusions were present. The abdomen was slightly distended; tenderness and rigidity were present over the lower abdomen. An hour later the entire abdomen was tender and rebound pain was present. The patient had developed pain in the left suprascapular region. Bowel tones were not heard. Red blood count was 3,400,000. Hemoglobin was 10 Gm. The white blood count was 24,000 with 94 per cent polymorphonuclears. Signs of shock deepened. Blood for transfusion was obtained.

The abdomen was opened four hours after the accident in expectation of a splenic injury.

The abdomen was entered through a left transverse incision. The peritoneal cavity contained a large quantity of clotted blood and bloody fluid. The spleen was normal. The incision was extended to the right and examination of the liver disclosed a deep laceration four inches in length on the inferior surface of the liver extending from the hilus to the costal surface (fig. 1). There was

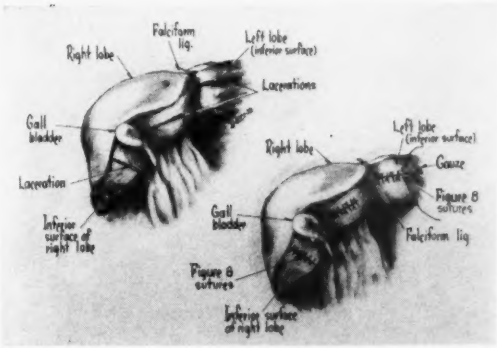

Fig. 1. Drawing illustrating lacerations on the inferior surface of the liver in Case 1.

a smaller two and a half inch laceration to the right. A third transverse laceration was noted just beneath the dome of the right lobe of the liver. Repair was carried out in the manner described above and drainage was instituted. Convalescence was uneventful and the patient was discharged on the tenth postoperative day.

The course and operative findings in this case are worthy of comment. Most significant, in contrast to the next 2 patients, was the rapid and uneventful convalescence. We attribute this directly to early exploration and repair. O'Neill[6] points out that shock from splenic rupture is more rapid and severe due to higher vascular pressure. Since there was evidence of left diaphragmatic irritation, and because shock appeared to be increasing in severity, a left abdominal approach was made. The ease with which a transverse incision can be extended to the right abdomen is to be noted. A third significant point is the early location of pain in the mid-abdomen. Wright, et al[4] refer to McKnight, who pointed out that laceration of the under surface of the liver often gave this symptom early.

CASE 2. T. B., an 11 year old boy, was admitted to Children's Hospital. One week before admission he fell over a plowshare, striking the right lower anterior ribs. He experienced persistent severe pain in this area for five days. The pain was partially controlled with oral sedatives. Vomiting occurred several times the night of the accident, after which he had no desire for food. The temperature was normal until the day before admission when it rose to 101° F. The urine was dark. On the day of admission the patient complained of pain in the right shoulder.

On admission, physical examination revealed a well-nourished boy lying quietly in bed with his legs flexed on his abdomen. Blood pressure 110/48. Pulse 138. Right upper quadrant tenderness was present and the liver border was tender and palpable 5 cm. below the costal margin in the mid-clavicular line. Urinalysis was normal. Red blood count was 2,400,000. White blood count was 14,000. Hemoglobin was 7.5 Gm. Coagulation time, 3 minutes; bleeding time, 2 minutes. Fluoroscopy of the hemi-diaphragms revealed the right one to be immobile. A "scout x-ray film" of the abdomen revealed the right upper quadrant density of the liver to extend downward to the iliac crest terminating in a margin more rounded than the usual sharp liver angle (fig. 2).

A saline enema was administered and a large formed, reddish brown stool

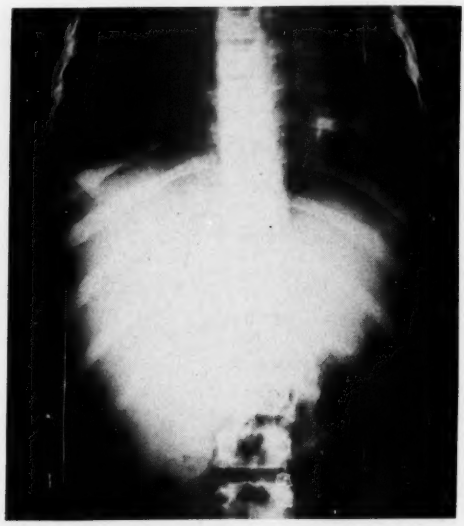

Fig. 2. Roentgenogram showing large subcapsular hemorrhage in Case 2.

was expelled. He complained consistently of abdominal pain. Blood was obtained and intravenous fluids were started immediately. Twenty-four hours after admission the patient was better hydrated. Abdominal exploration was carried out through a high right transverse incision. On opening the peritoneum a moderate amount of free blood was encountered. Glisson's capsule on the superior surface of the right lobe was distended and a small disruption at the anterior edge was seen. The capsule was opened, revealing a large subcapsular laceration filled with old blood clots (fig. 3). All clots were removed; the rent in the liver was repaired and drainage was instituted.

The immediate postoperative condition was good. Whole blood, penicillin, and intravenous aureomycin were administered. Two hours following exploration the temperature rose to 106° F. and the patient became delirious. A hemolytic transfusion reaction was excluded by a negative examination for hemoglobinuria. The patient was critically ill for 48 hours, after which time the fever subsided. Thereafter, his convalescence was uneventful, with hospital discharge after 19 days.

This case presents the picture of a ràther minor type of original injury with an extensive rupture of the liver which was masked for a week despite the pain and marked anemia. The failure of shock development can be attributed to the slow hemorrhage which was partially retarded by the liver capsule. The severe postoperative hyperpyrexia and delirium were probably due to toxemia from decomposed proteins.

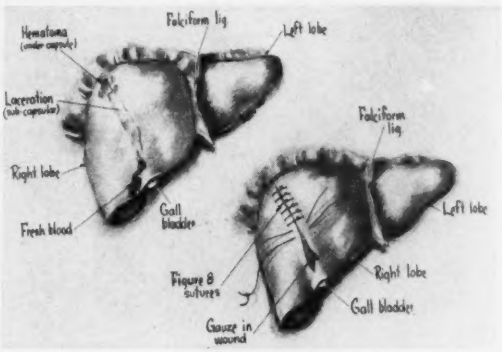

Fig. 3. Illustration of subcapsular laceration of liver found at operation in Case 2.

CASE 3. K. B., a 15 year old boy, was kicked in the abdomen by a horse 10 days before admission to Children's Hospital. He experienced immediate upper right quadrant pain and vomited several times. His attending physician considered him to be in a mild state of shock and gave sedation and blood transfusions. The patient's symptoms subsided. Twelve hours before admission to the hospital he experienced severe upper right quadrant pain, nausea, vomiting, and was in moderately severe shock. He was given another 500 cc. blood transfusion and referred to the hospital. His condition appeared so critical upon admission that he was taken immediately to the operating room. A "scout x-ray film" of the abdomen and blood count were obtained en route. Examination revealed a pale, mildly icteric boy. The skin was clammy, the pulse thready and moderate dyspnea was noted. The abdomen was tense, distended, and tympanitic. There was severe right upper quadrant tenderness and spasm. Red blood count was 3,370,000. Hemoglobin was 11 Gm. White blood count was 20,350. Coagulation time, 4 minutes; bleeding time, 1 minute.

A blood transfusion was started and the abdomen opened. A large quantity of fresh blood, blood clots and bile were encountered. Exposure of the liver revealed a large rent 30 cm. in length on the superior surface of the right lobe extending from the costal border to the dome (fig. 4). The previously described method of rupture repair was completed and drainage instituted.

His postoperative course was stormy and characterized by a spiking fever to 103° F. daily for several days, anorexia, apprehension and right upper quadrant pain. On the eleventh hospital day, splinting of the right chest, fever and leucocytosis drew attention to the subdiaphragmatic area (x-ray). A large subdiaphragmatic abscess was drained. Following this, he improved steadily

and on the twenty-fifth hospital day was discharged. The final drains were removed shortly before discharge. On the way home by air, some 400 miles away, he developed massive bleeding from the drain sites. Blood transfusions were again administered and the bleeding controlled. Three weeks later his condition was reported as being satisfactory.

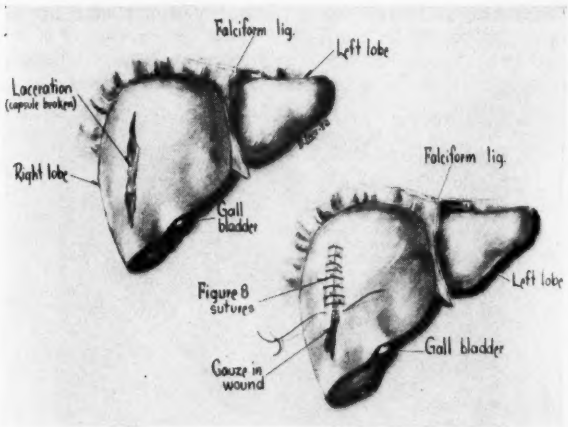

Fig. 4. Drawing to show laceration right lobe of the liver, and method of closure utilizing Oxycel gauze in Case 3.

CASE 4. N. H., a 16 year old girl, was admitted to St. Joseph's Hospital five hours after being in an automobile accident. She was unconscious for a short period of time and, upon regaining consciousness, complained of severe pain in the head, right shoulder and abdomen. Because of a moderate degree of shock she was given plasma.

Examination revealed a pale, restless girl with a cloudy sensorium and considerable nausea. A recent small contusion was present on the right temple. Temperature 97.6° F. Blood pressure 100/68. Pulse 112. No evidence of trauma to the abdomen was noted. Extreme tenderness and rebound pain was present throughout the abdomen. Peristaltic tones were absent. Red blood count was 3,780,000. Hemoglobin was 9 Gm. White blood count was 18,250. The coagulation time was 4 minutes and bleeding time was 20 seconds. Her general condition appeared to be declining. The abdominal signs assumed increased prominence and a laparotomy was performed six hours after admission. A large quantity of bloody fluid and clots were removed. When adequate exposure of the liver was obtained an extensive stellate fracture of the superior portion of the dome of the right lobe extending almost to the hilus was discovered (fig. 5). Three pieces of tissue were found to be entirely separated from the liver. A large portion of liver on the far side of the right lobe was separated and hanging free. Suture of the liver was performed with difficulty. Bleeding from the liver wound was brisk. The free liver fragments were removed, repair accomplished and drainage established.

Her immediate postoperative condition was improved, although her fever reached 103° F. There was diminished urine output the first week. On the twelfth postoperative day the patient complained of some right chest pain and

suffered slight dyspnea in spite of adequate oxygen administration. She was reluctant to eat. Signs of pleural effusion developed and were confirmed by x-ray examination. Two hundred and fifty cc. of blood-tinged fluid were removed from the right pleural space. Rechecks revealed no further fluid accumulation and the lung field cleared completely in a week. She had persistent right shoulder pain throughout her hospital stay. No local injury was discernible and referred pain from the diaphragm seemed to be the logical cause. Drainage from the abdominal wound was so persistent and profuse that drains were removed very slowly, taking a total of 40 days. She was discharged 73 days after admission. Two months after discharge she had gained 9 pounds and appeared well-nourished. The thymol turbidity was 5.5 units and serum bilirubin 0.85 mgm. per hundred grams.

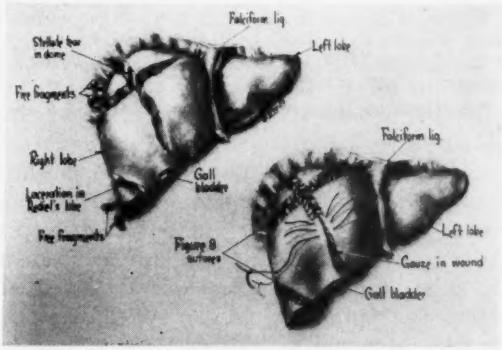

Fig. 5. Extensive liver trauma found in Case 4. Both Gelfoam and Oxycel gauze were used to control the bleeding.

The girl's entire convalescent period was marked by frequent bouts of nausea, vomiting and anorexia which necessitated the administration of unusual amounts of parenteral therapy. An appreciable weight loss occurred and an icteric tinge of the skin was noted on several occasions. It seems evident that a rather serious degree of liver damage was present. We felt justified in assuming prolonged hospital surveillance for these reasons.

SUMMARY

Traumatic rupture of the liver is not an uncommon type of abdominal injury. The degree of trauma is sometimes slight and the absence of external abrasions misleading. The diagnosis is difficult. However, each of the 4 cases reported herein demonstrated the following: (1) history of injury, (2) abdominal pain and distention, (3) abdominal tenderness and muscle spasm, (4) shock, (5) nausea, (6) anemia, (7) leukocytosis.

The operative technic and management of the 4 cases has been described. Extensive drainage with Penrose drains is recommended. The complications noted in our patients were: toxemia, subphrenic abscess, pleural effusion, poor nutritional balance and recurrent

hemorrhage. The necessity for large doses of chemotherapeutic drugs has been stressed.

The morbidity increases as the time between injury and surgical exploration lengthens. Thus the importance of early diagnosis should be re-emphasized.

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THE SURGICAL TREATMENT OF AORTIC THROMBOSIS

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SLOWLY progressive thrombosis of the abdominal aorta has been considered a disease of great rarity. This peculiar syndrome is entirely unrelated to and is to be sharply differentiated from the acute embolic obstruction and rapidly progressive thrombosis so commonly seen in cardiac patients. As early as 1814, Graham[1] emphasized that embolic occlusion of the terminal aorta and primary aortic thrombosis were two distinct entities.

In 1898 Welch[2] collected 59 reported cases of embolism and thrombosis of the terminal aorta; and only 7 of these were primarily thrombotic. Leriche's[3] first report concerning the disease appeared in 1923, and in 1940[4] he reported 5 cases in which the diagnosis was confirmed at operation. In 1943 the literature relating to embolic and thrombotic occlusion of the abdominal aorta was reviewed by Greenfield,[5] but he failed to state how many of his 161 collected cases were instances of primary thrombosis. In 1946 Holden[6] reported 2 cases of thrombotic obliteration of the aortic bifurcation successfully treated by sympathectomy. Again in 1948 Leriche[7] presented a fine summary of his experience in the treatment of the disease and re-emphasized the ease with which cases of insidious thrombosis of the abdominal aorta could be differentiated from cases of acute embolic obstruction and rapidly progressive thrombosis. Since the excellent report of Elkin and Cooper[8] in 1949, it has become increasingly apparent that insidious thrombosis of the aorta must occur much more frequently than is generally appreciated. These authors discovered 10 cases in their clinic in 20 months. In the discussion of the report of Elkin and Cooper before the American Surgical Association in 1949, 4 additional cases were reported by Holman[9] and 1 by Gage.[10]

PATHOLOGY

Pathologically, in arteriosclerosis obliterans of the large arteries, the earliest and most extensive lesions frequently occur in the terminal aorta. The atheromatous plaques progressively degenerate to become soft and friable, and ultimately break through the intima to produce multiple ulcers, the edges of which are irregular and calcified. The roughened surface predisposes to throm-

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bosis which eventuates in partial or complete occlusion of the aortic lumen. Simultaneously, the muscular layer becomes thinned, fibrotic, and calcified. Both the media and the adventitia are infiltrated with lymphocytes; and occasionally there occurs around the thrombosed segment such an extensive periarteritis that the aorta becomes densely adherent to prevertebral tissues, veins, lymphatics, and sympathetic ganglia.

Thrombosis may begin in one of the common iliac arteries and progressively extend proximally into the aorta and eventually completely occlude it. Propagation may proceed proximally until the orifices of the renal arteries are occluded, and death ensues as the result of hypertensive cardiovascular disease and uremia.

Leriche[7] feels that perhaps less commonly the thrombosis begins at or above the aortic bifurcation and later extends into the common iliac arteries. The final result is obliteration of the terminal aorta and both iliacs.

It is to be emphasized that these pathologic changes develop very gradually, usually over a period of years.

Symptomatology

Pain in the hips and legs, extreme fatigability, intermittent claudication, and sexual impotency are the most frequent symptoms.

In the 10 cases reported by Elkin and Cooper[8] the average duration of symptoms was seven years, although in their patients there was considerable variation in the progression of symptoms and physical signs. As pointed out by Holden,[6] symptoms appear in direct relation to the ischemia of the lower extremities and in inverse proportion to the adequacy of the collateral circulation.

Diagnosis

A provisional diagnosis of thrombotic occlusion of the terminal aorta may be made whenever a patient complains of exertional pain in the hips and thighs, or of easy fatigability of the legs, or of sexual impotency, and examination discloses no pulsations in vessels distal to the umbilicus. Pallor of the feet on elevation, and rubor and cyanosis on dependency are frequent findings. Trophic changes of the skin and nails are usually present. Atrophy and gangrene are late changes, and the diagnosis should be made before they occur.

Slowly progressive thrombosis of the aorta is usually so insidious in its onset that for years symptoms are mild, and collateral circulation is so abundant that necrosis is delayed for a long period. In striking contrast, embolic occlusion is sudden in onset, pain is severe,

and signs of marked ischemia appear immediately. In both thrombosis and embolism usually no arterial pulsations are palpable below the umbilicus. Both conditions, if not properly treated, will eventuate in gangrene—after a few days in the patient with embolism, after a few years in the patient with thrombosis.

Calcification of the abdominal aorta is frequently evident on roentgenographic examination. Aortography will confirm the diagnosis and reveal the level of the obstruction.

Prognosis

If treatment is instituted before gangrene and ulceration have appeared, relief of symptoms is remarkable in most instances. Prolonged survival is to be expected; and death usually is due to the complications of arteriosclerosis, i.e., myocardial infarction, hypertension, or uremia. A fatal infection may develop in a gangrenous extremity.

Treatment

Leriche[7] has stated that the ideal treatment of thrombotic obliteration of the terminal aorta would be to resect the occluded segment, and to re-establish continuity of the vessel by the insertion of a vascular graft. Gross[11] has employed preserved aortic homografts to bridge the defect resulting from resection of a lengthy segment of the congenitally coarcted aorta. This may not be feasible in arteriosclerosis obliterans of the terminal aorta because the iliac arteries are also involved. Moreover, the suturing of a graft into the aorta of a child is technically an entirely different problem from that which would be encountered in working with the rigid, calcified, friable aorta of the older patient with obliterative arteriosclerosis.

Bilateral lumbar sympathectomy destroys the vasoconstrictor nerve supply to the collateral vessels distal to the obstruction, and should be performed in all cases.

There is a difference of opinion relative to the advisability of resecting the aortic bifurcation and the thrombosed area. Leriche[7] believes that aortectomy, whenever feasible, should be performed in order to interrupt arterial vasoconstrictor reflexes, and to check the spreading thrombosis. Terminal aortectomy was performed in only 1 of the 10 cases treated by Elkin and Cooper.[8] Holman[9] and Reichert[12] feel that resection of the calcified aorta is too hazardous for the gain obtained, and advise only sympathectomy.

Case Reports

Case 1. E. B., a 53 year old Negro male, had for many years been a

patient at the Arkansas State Hospital for Mental Diseases. The writer saw him in consultation in September, 1949, because of gangrene of the left foot. It was impossible to elicit a history. Examination disclosed marked generalized arteriosclerosis. Weakness of the right side of the body had been present since a cerebral vascular accident two years ago. The left foot was cold and gangrenous, and atrophy and trophic changes were present in both feet. Weak aortic pulsations were palpable below the umbilicus, but the pulses were absent in both lower extremities. The gangrene of the left foot required immediate supracondylar amputation. The stump healed poorly, necessitating reamputation. Three months later the right foot became gangrenous and a low thigh amputation was performed. Again, reamputation at a higher level was necessary. On April 18, 1940, the writer was again asked to see the patient because of ulceration and constant pain in the right amputation stump. A clinical diagnosis of thrombosis of the terminal aorta was made, and this impression was confirmed by aortography (fig. 1). A bilateral lumbar sympathectomy resulted in complete relief of pain and healing of the wound.

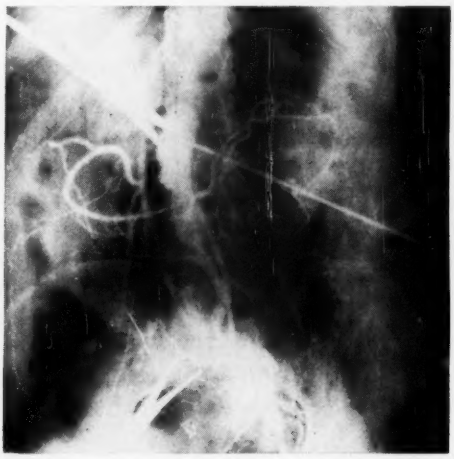

Fig. 1—Case 1. Aortogram showing complete occlusion of the right common iliac and left external iliac arteries, and partial obliteration of the lumen of the distal aorta.

Comment. Obviously, there was entirely too great a delay in making the diagnosis in this case. Though no history was available, and weak pulsations were palpable in the distal aorta, the presence of gangrene of the foot and the absence of arterial pulsations in the lower extremity should have led to a provisional diagnosis of obliteration of the distal aorta or iliac arteries. An aortogram would have confirmed the diagnosis and appropriate treatment at that time would probably have saved the patient three operations and his right leg.

CASE 2. L. C., a 54 year old white female, was admitted to the University Hospital on Jan. 27, 1950, complaining of weakness, easy fatigability, pain in

the hips and legs, intermittent claudication, and nocturnal cramps of five years duration. For eight weeks prior to her admission, constant severe aching and burning pain associated with gangrene of the right foot had been so severe that large doses of codeine were required at three hour intervals.

There were ulceration and gangrene of the right foot, bilateral diffuse atrophy, trophic changes in the nails and skin, pallor on elevation and rubor on dependency. Pulsations of the abdominal aorta were not palpable below the umbilicus, and in the lower extremities all pulses were absent. The feet were warm.

A clinical diagnosis of insidious thrombosis of the terminal aorta was made and confirmed by aortography (fig. 2).

Fig. 2—Case 2. Aortogram showing occlusion of the aorta at a point between the origins of the superior and inferior mesenteric arteries, about 4 cm. above the bifurcation of the abdominal aorta.

Treatment consisted in bilateral lumbar sympathectomy which resulted in striking symptomatic improvement. However, the gangrene of the right foot was an irreversible process, and a high thigh amputation was required. The stump has not healed completely.

Comment. The diagnosis was made in this case at the time of the patient's first visit to the hospital, but it was too late to save the gangrenous extremity. Had she received treatment three months earlier it is very unlikely that amputation would ever have been necessary.

SUMMARY

Two cases of insidious thrombosis of the aorta are presented.

The literature is briefly reviewed; and the syndrome is discussed with reference to pathology, symptomatology, diagnosis, prognosis, and treatment.

The recent marked increase in the number of reported cases suggests that the disease occurs with much greater frequency than is generally appreciated.

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THE MECKEL'S DIVERTICULUM

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IT IS difficult for a general surgeon in a small town to prepare a constructive scientific paper for presentation to The Southeastern Surgical Congress. My chief excuse for accepting a place on this program is the fact that a large number of the members of this Congress have an environment similar to mine from which they draw their work.

During my 12 years in private practice I have become interested in an entity well known to all but one which I feel is given too little consideration as being the cause of gastrointestinal complaints. This entity is the Meckel's diverticulum.

This condition derived its name from J. T. Meckel[9] who first appreciated its embryological, anatomical, and pathological significance in 1812. The presence of such a condition was mentioned by Hildanus in 1598 as reported by Lichtenstein.[8] Since then innumerable papers have been written with regard to the condition.

The Meckel's diverticulum results from an incomplete obliteration of the omphalomesenteric duct which connects the yolk sac with the intestine. The obliteration of this duct begins in about the fifth week of fetal life and is usually completed about the seventh week.[3] Failure of obliteration of the duct may result in any of the following conditions:

1. The formation of a draining sinus at the umbilicus if all but the distal end is closed, the remaining glandular elements being the source of the mucus secretion.

2. A retention cyst if the mid-portion of the duct does not resolve.

3. A fibrous cord. This cord may extend from the intestinal tract to the umbilicus and contain no epithelial elements.

4. A Meckel's diverticulum if the proximal portion of the duct does not involute.

Any combination of these developmental anomalies may be present. The most frequently encountered condition resulting from incomplete obliteration of the vitello-intestinal duct is the Meckel's diverticulum, the condition to be considered in this paper.

The histologic structure of the Meckel's diverticulum is identical with that of the ileum except that in addition it may contain hetero-

Presented during the Washington Assembly of The Southeastern Surgical Congress, Washington, D. C., March 6-9, 1950.

topic tissue similar to gastric, duodenal, or colonic mucosa or identical with pancreatic tissue. The Meckel's diverticulum may vary in length from a barely perceptible convexity on the ileum to 10 inches in length. The diameter of the ostium of the diverticulum may be from pin-point width to a width greater than the diameter of the ileum. Meckel's diverticula have been reported at variable locations along the intestinal tract but the usual location in adults is about 18 inches proximal to the ileocecal junction. In infants a relative nearness to the ileocecal junction exists. The diverticulum may occur in any part of the circumference of the bowel but is found arising most frequently from the antimesenteric border.

According to Ladd[7] a Meckel's anomaly is present in about 4 per cent of all newborn infants. From autopsy reports[4-2] about 2 per cent of adults persist with the condition. Faust[5] feels that from 15 to 20 per cent of people with Meckel's diverticula have symptoms referable to the condition. This would suggest that one out of 300 of the population has gastrointestinal symptoms resulting from the presence of a Meckel's diverticulum.

The symptoms and findings resulting from pathologic changes associated with the presence of a Meckel's diverticulum are numerous and varied. The symptoms and findings more commonly encountered are: (1) fistula, (2) diverticulitis, acute or chronic, (3) intestinal obstruction, (4) hemorrhage, (5) perforation with peritonitis, and (6) dyspepsia.

The probability of making an accurate preoperative diagnosis of a Meckel's diverticulum being the cause of the above symptoms or findings is extremely remote except in the instance of an umbilical fistula or painless bleeding from the rectum in infants. The source of the fistula can be established by x-ray. According to Good and Fletcher[6] less than 50 cases were reported prior to 1942 where a Meckel's diverticulum was identified by x-ray. They concluded that, "The usefulness of the roentgenologic examination of the small intestine in a case of suspected Meckel's diverticulum rests, therefore, on the ability of the method to exclude other lesions which might produce the symptoms of which the patient complains rather than on its capacity for visualizing the diverticulum." Also that, "The diagnostic accuracy of the roentgenologic examination of the small intestine in the type of lesion discussed is highest in cases of regional enteritis, fairly high in cases of benign and malignant tumor and lowest in cases of Meckel's diverticula."

The presence of a Meckel's diverticulum can be strongly suspected in cases with bleeding from the bowel after other more easily

SUMMARY OF CASES—*Meckel's Diverticulum*

Case No.	*Age*	*Sex*	*Preoperative Diagnosis*	*Operative Findings*	*Pathological Findings*	*Treatment*	*End Result*
1	72	F	Intestinal obstruction, incomplete, from right inguinal hernia	Littre's hernia and Richter's hernia	Destruction of mucosa of Meckel's diverticulum, due to acute inflammation	Resection of diverticulum. Relief of Richter's hernia, and herniorrhaphy	Recovery
2	28	F	Acute appendicitis	Acute Meckel's diverticulum, 1.5 x 6 cm. Normal appendix	Acute Meckel's diverticulum, without heterotopic tissue	Resection of diverticulum. Appendectomy	Recovery
3	9	M	Intestinal obstruction	Ileum and colon filled with ascaris, with 5 ascarids filling Meckel's diverticulum with half their bodies. Fibrous cord from Meckel's to umbillicus, and volvulus about cord	Normal Meckel's diverticulum with fibrous cord from dome. No heterotopic tissue	Reduction of volvulus. Replacement of ascarids into ileum. Resection of Meckel's diverticulum and attached fibrous cord	Recovery. 86 ascarids recovered at a later date
4	2 mo.	M	Intestinal obstruction	Ileocolic intussusception, originating from inverted Meckel's diverticulum	Necrotic Meckel's diverticulum	Reduction of intussusception. Resection of diverticulum	Death, 4 hours post-operative
5	18	M	Acute appendicitis	Acute Meckel's diverticulum, 2 x 7.5 cm. Normal appendix	Acute Meckel's diverticulum with gastric mucosa	Resection of diverticulum. Appendectomy	Recovery
6	17	F	Chronic recurrent appendicitis	Appendix acutely flexed and obstructed in mid-portion. Meckel's diverticulum 4 x 10 cm.	Minimal acute appendicitis. Meckel's diverticulum without heterotopic tissue	Appendectomy. Resection of Meckel's diverticulum	Recovery

SUMMARY OF CASES—*Meckel's Diverticulum* (Cont'd)

Case No.	*Age*	*Sex*	*Preoperative Diagnosis*	*Operative Findings*	*Pathological Findings*	*Treatment*	*End Result*
7	39	M	Chronic recurrent appendicitis	Meckel's diverticulum, 4 x 15 cm., arising from lateral aspect of ileum falling away from its mesentery, causing partial obstruction. Normal appendix	Meckel's diverticulum without heterotopic tissue. Normal appendix	Resection of Meckel's diverticulum. Appendectomy	Recovery
8	68	M	Intestinal obstruction	Distended proximal ileum with 1 x 4 cm. Meckel's diverticulum adherent to cecum and associated volvulus	Meckel's diverticulum with partial necrosis of mucosa. No heterotopic tissue	Division of adhesions. Reduction of volvulus. Resection of Meckel's diverticulum	Recovery
9	24	F	Chronic recurrent appendicitis	Obstructed appendix. Meckel's diverticulum with ostium 4 cm. and length 1.5 cm.	Acute appendicitis	Appendectomy. Diverticulum not removed	Recovery
10	31	F	Chronic cholecystitis with cholelithiasis	Chronic cholecystitis with cholelithiasis. Meckel's diverticulum with ostium 3 cm. and length 2 cm. Normal appendix	Chronic cholecystitis with cholelithiasis. Normal appendix	Cholecystectomy. Appendectomy. Diverticulum not removed	Recovery
11	16	M	Acute appendicitis	Normal appendix. Meckel's diverticulum, 2 x 6 cm. Mesenteric adenitis	Normal appendix. Meckel's diverticulum without heterotopic tissue	Appendectomy. Resection of Meckel's diverticulum	Recovery

detected conditions have been eliminated. A Meckel's diverticulum should also be considered as the starting point of an intussusception.

Most frequently the identification of the Meckel's diverticulum as the causative agent of an intra-abdominal disorder is done at the time of surgery. Preoperative diagnoses most often present when Meckel's diverticula are encountered are acute appendicitis, intestinal obstruction or peptic ulcer.

Table 1 is a summary of 11 cases of Meckel's diverticula encountered by the author in a period of eight years. The findings correspond rather closely to other reports with respect to age incidence, sex, location, and absence of accurate preoperative diagnosis. The presence of gastric mucosa in only 9 per cent of the cases is below the average of 16 per cent as reported by Schaetz.[1] The 36 per cent incidence of cases with intestinal obstruction resulting from the presence of Meckel's diverticula is rather high by comparison. No case of melena, tumor, perforation, or fistula was found. Seventy-three per cent of the Meckel's diverticula encountered were productive of symptoms. Meckel's diverticula were searched for only in those cases where the suspected offender, usually the appendix, was found unlikely to be responsible for the patient's difficulty. No gynecological surgery is done by the author and as a result no cases in this series were incidental to pelvic surgery.

The treatment of the symptomatic Meckel's diverticulum consists of its removal or of the relieving of the disabling condition, such as intestinal obstruction, and then its removal. The treatment of the asymptomatic Meckel's diverticulum consists of its removal unless the diameter of the ostium is greater than the length of the diverticulum. The removal of the asymptomatic Meckel's diverticulum is important because of the probability of future trouble arising from it.

The surgical handling of the Meckel's diverticula in this series was constantly the same. If a mesentery existed, it was divided. The diverticula were resected with clamps placed parallel to the bowel and at 90 degrees to each other. Closure was made transversely with two tiers of intestinal catgut. No proximal decompression was used and no duodenal drainage was instituted. If the diameter of the base of the diverticulum should make the above type of removal impossible, an intestinal resection should be done. No case in this series required intestinal resection. The usual postappendectomy routine was adhered to.

Conclusion

The Meckel's diverticulum is not a surgical oddity but is an entity frequently encountered and capable of producing varied and

serious intra-abdominal situations. The relief of these situations depends on the search for and the removal of the diverticulum and the correction of associated conditions. Due to the high frequency of involvement of the Meckel's diverticulum it should be searched for and, if found, removed in all laparotomies, unless contraindications exist, even though it is asymptomatic at the time. Mortality from the resection of Meckel's diverticula should be minimal.

Summary

Eleven cases of Meckel's diverticula from a general surgical practice in a small community are presented. A suggestion for a more frequent consideration of this condition is made.

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THE SURGICAL TREATMENT OF INTRACRANIAL ANEURYSMS

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THE surgical possibilities of direct attack on intracranial aneurysms excited little interest until the publication of Dandy's[1] monograph reviewing his experiences with 108 patients with intracranial aneurysms. This classical work was completed and published before the general use of diagnostic cerebral angiography. With Dandy's demonstration that many such lesions could safely be subjected to operative attack and with the rapid development of angiography as a valuable diagnostic adjunct, surgical interest in these lesions has become widespread.

There is now little doubt that many intracranial aneurysms can be cured by surgical methods without undue risk to life. It is true that aneurysms in certain intracranial locations cannot be approached without grave risk to life or permanent neurologic crippling. In a few areas obviously surgically inaccessible, aneurysms must remain a lesion of academic interest.

Since the mortality from aneurysms which have already produced major episodes of bleeding is high, the necessity of early diagnosis and demonstration of the aneurysm is obvious. It is true that many will survive an initial attack of bleeding, but subsequent and perhaps fatal bleeding is almost certain to follow. Therefore, it is of utmost importance that every attempt be made to cure the aneurysm as soon as it is demonstrated and found to occupy an accessible location.

Regardless of their size, aneurysms of the carotid canal are the simplest and the safest to treat surgically (fig. 1). The most certain cure of the aneurysm is effected by the "trap" operation in which the internal carotid artery is ligated in the neck. A small frontal bone flap is then turned down using the well-known concealed incision and a clip is placed on the intracranial portion of the artery above the aneurysm, thus completely isolating it from all sources of blood supply. The procedure may be carried out in one or two stages, but it is essential that tolerance to carotid occlusion be demonstrated beforehand.

Sacular aneurysms of the intracranial portion of the carotid comprise the most common group. Situated in the region of the caver-

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Presented during the Washington Assembly of The Southeastern Surgical Congress, Washington, D. C., March 6-9, 1950.

nous sinus or close to the point of junction with the posterior communicating artery, they seldom reach large size without spontaneous rupture. The oculomotor nerve is frequently compressed and the

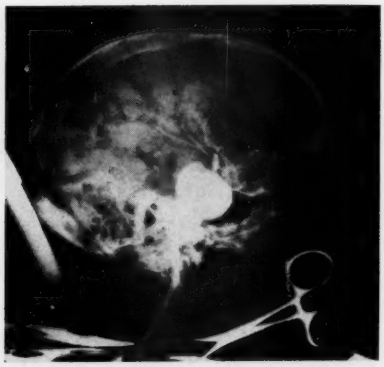


Fig. 1. "Angiogram showing aneurysm of carotid canal."

Fig. 2-a. Aneurysm of intracranial carotid artery.

Fig. 2-b. X-ray showing clips on neck of aneurysm.

resulting oculomotor palsy is practically diagnostic of aneurysm in this location. It is in this situation that the surgeon realizes the most opportune chance for cure of the aneurysm without interference with blood supply to the brain. Frequently the aneurysm presents a small neck upon which a clip may be placed, leaving carotid circulation unimpaired. This necessitates gentle dissection of the aneurysm in order to mobilize it and free the base of the sac from the arachnoidal adhesions surrounding it. Since the sac is frequently thin-walled and friable, rupture of the aneurysm is to be anticipated

during the dissection. This has happened in each of the three instances in which I have been able to clip the neck of the aneurysm. Bleeding is easily and readily controlled by temporarily occluding the carotid artery, allowing the operator to clip the base of the sac (fig. 2). In the event of splitting of the sac into the neck of the aneurysm close to the carotid, there is no recourse but to trap the area between clips placed on the carotid.

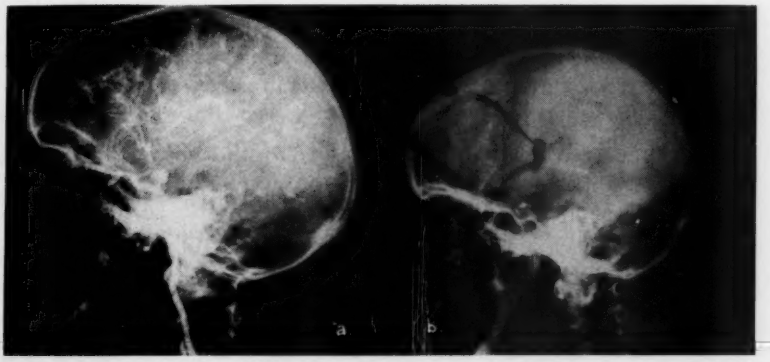


Fig. 3-a. Aneurysm of posterior communicating artery.

Fig. 3-b. X-ray showing clips on neck of aneurysm.

In a recent case this was necessary because of total rupture of the sac with profuse hemorrhage from the carotid orifice of the aneurysm. Progressive thrombosis occurred with resulting complete hemiplegia. While it is always advisable to demonstrate the patient's tolerance to carotid occlusion, this by no means gives assurance that circulatory impairment from thrombosis will not occur.

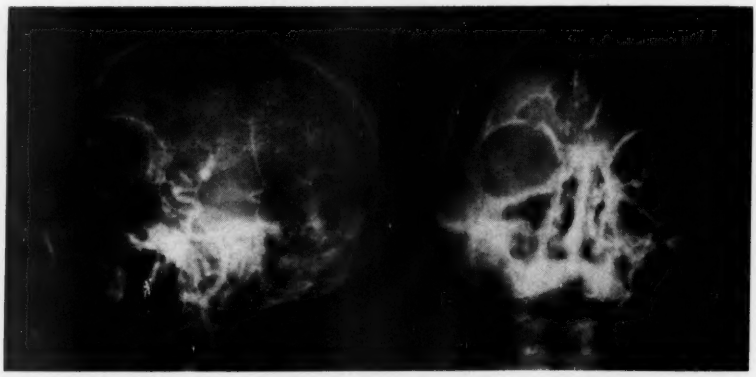
From the viewpoint of complete cure of the aneurysm, there is little doubt that direct attack on the aneurysm surpasses the simple ligature of the carotid artery in the neck. Jaeger[2] has recently emphasized this philosophy in the treatment of such aneurysms. It has been our practice to utilize carotid ligation only in the treatment of arteriovenous fistulae and aneurysms of the carotid canal.

Aneurysms which develop from the anterior cerebral or anterior communicating arteries require the clipping of at least one anterior cerebral artery in addition to small feeder vessels. We have demonstrated only two aneurysms in this location. One patient refused operation and expired shortly afterward from a massive hemorrhage. The second patient was operated on and a large aneurysm removed by Dr. Pilcher who found it necessary to occlude both anterior cerebral arteries. Elvidge and Feindel[3] have recently re-

ported 2 patients with anterior cerebral aneurysms cured by removal of the aneurysm in 1 and obliteration by clipping in the other.

Aneurysms involving the posterior communicating artery near the carotid artery produce essentially the same signs and symptoms as do those of the internal carotid (fig. 3). The operative exposure and method of treatment are the same. However, when located on the middle or posterior portions of the posterior communicating artery, they become practically inaccessible surgically. Furthermore, angiographic demonstration in this location is less certain, since the contrast media may not enter this vessel in sufficient concentration to afford adequate filling of the sac.

We have seen no sacular aneurysms of the posterior cerebral artery. Few will be disclosed by angiography until vertebral arteriography is employed more frequently. In Dandy's series only two posterior cerebral aneurysms are described, both of which were found at autopsy.



Figs. 4-a and b. Bilobular aneurysm of middle cerebral artery.

Aneurysms of the middle cerebral artery present a most perplexing problem in therapy (fig. 4). The lesion can be exposed surgically, but neurologic crippling is certain to result from occlusion of the middle cerebral artery. Decision regarding acceptance of the great risk to life or permanent morbidity will require the most serious deliberation before surgical recommendations can be made.

It is rarely possible to demonstrate aneurysms arising from the intracranial vertebral arteries, basilar artery, or posterior and anterior inferior cerebellar arteries. Occasionally found during suboccipital exposure for tumor or cranial nerve section, they are gen-

erally operable, although occasionally one might be cured if found on a vertebral artery or on one posterior inferior cerebellar artery. Angiography via the vertebral artery may disclose such an aneurysm, but this method has been used too little to allow any generalizations concerning its efficacy. Only additional experience will determine the frequency in which aneurysms in this location prove to be surgically assessible.

SUMMARY

With the development of cerebral angiography as a satisfactory diagnostic method of demonstration of intracranial aneurysms, specific advances in the surgical treatment of these lesions have developed. Direct excision or obliteration of the aneurysm can safely be anticipated in many instances. The role of simple carotid ligation in the treatment of intracranial aneurysm is not clearly understood and may accomplish little other than the diminution of intra-aneurysmal tension.

Sacular aneurysms located on the internal carotid, anterior communicating, anterior cerebral, and posterior communicating arteries should be treated by the safest method which will eliminate the aneurysm while preserving a maximum of cerebral circulation.

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PRESENT STATUS OF THE SURGICAL THERAPY OF GASTRIC AND DUODENAL ULCER

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DURING the past half-century, there has been a remarkable fluctuation in opinion as concerns the indications for surgical treatment when a diagnosis of peptic ulcer is made, as well as regarding the type of surgical procedure which should be employed in the individual case. Especially during the days when gastroenterostomy and pyloroplasty were in vogue, many patients were submitted to laparotomy whose ulcers would undoubtedly have healed on a conservative medical regime.

An astonishing amount of labor has been expended in an effort to determine the cause of peptic ulcer, as well as to determine the adequacy of various surgical procedures proposed for the treatment of the disease. These efforts, most marked in the last 25 years, including laboratory experimental work as well as periodic evaluation of clinical data, have been stimulated especially by three developments: (1) The demonstration by Mann and Williamson[16] that jejunal ulcers could be produced uniformly in the experimental animal by deviation of the duodenal contents into the terminal ileum, accompanied by gastrojejunostomy; (2) The utilization of the prolonged action of histamine as a satisfactory method of producing gastric and duodenal ulcers in the experimental animal by Wangensteen's group;[27] (3) The reintroduction by Dragstedt[5] of vagus resection as an operation useful in the treatment of peptic ulcer.

In perusing some of the mass of accumulated literature on the subject, one is struck by the lag between experimental observation and clinical application. If a surgeon is to be more than a simple artisan, he must be capable of choosing for a given condition a procedure which, from a rational point of view, should correct the pathological physiology involved. The days when surgery was limited to removal of diseased tissue are long past, and it is imperative that the surgeon understand the nature of the disease he attempts to treat.

The etiology of gastric and duodenal ulcer is unknown, but certain factors concerned are apparent.[17] Perhaps the most important factor is the ability of an acid-peptic mixture under certain conditions to digest gastric and intestinal mucosa. Of secondary impor-

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Presented during the Washington Assembly of The Southeastern Surgical Congress, Washington, D. C., March 6-9, 1950.

tance is the repeated observation that ulcers most commonly occur along the lesser curvature of the stomach and in the first portion of the duodenum, areas where the mucosa is more adherent, and the rugations less pronounced. These observations emphasize the role of the mechanical action of food, and the "jet effect" of gastric chyme as it is squirted through the pylorus. The psychosomaticists, and, to a lesser extent, the vagotomists, have emphasized the importance of the neurogenic factor. Diminished tissue resistance, whether due to vascular disturbances, allergies, nutritional deficiencies, or inflammation, has been assigned an important part in the etiology of the disease. To date, no operation devised for the treatment of this disease will cope with all of these factors.

The surgery of peptic ulcer is predominantly concerned with complications: perforation, hemorrhage, and obstruction. Less frequently, the surgeon is consulted by patients who have failed to respond to adequate medical therapy over a long period of time, or who are unable, for a variety of reasons, to follow an adequate medical regime. It is in these cases of uncomplicated but refractory duodenal ulcer that the surgical results are likely to be worst, and such patients should have the benefit of expert evaluation through the joint efforts of the internist, psychiatrist, and surgeon. Uncomplicated gastric ulcer presents a quite different problem, since it is almost axiomatic that a competent pathologist is unable to determine with certainty by gross examination whether or not a given gastric ulcer is benign, and must await paraffine sections in order to diagnose malignancy.[1] Obviously, x-ray, gastroscopy, gastric analysis, and Papanicolau smears are all fallible in this respect. Therefore, if we are to improve the distressingly poor long term results now achieved in gastric carcinoma, we must accept the dictum that any gastric ulcer which fails to heal in a short period of time should be resected.

Perforation, with the concomitant contamination of the peritoneum, is a catastrophe which requires prompt surgical intervention. Since operation is undertaken primarily as a lifesaving procedure, the simplest possible measure which will suffice to stop leakage into the peritoneum is the operation of choice. Usually, this will involve simple closure of the perforation, either by suture or by omental graft. With such procedures, the mortality rate, which was over 20 per cent at the University of Virginia in the years 1925 through 1938, for the years 1944 through 1948 was only 4.3 per cent.[18] This reduction in mortality occurred concomitantly with the increased use of intragastric suction, sulfonamides, antibiotics, early ambulation, and improvement in the understanding of preoperative and postoperative care. One must be cognizant of statistical evi-

dence that closure of a perforated ulcer is not a curative procedure. Many of these cases will again have ulcer symptoms. With such a low mortality rate, it would seem unwise to treat perforated ulcer conservatively with suction, antibiotics, and parenteral fluids, as advocated by Visick,[26] except in the occasional very poor operative risk, or in the individual who presents himself some time after perforation with a full-blown peritonitis. In certain exceptional cases of perforation, particularly young individuals in good condition, with perforation of short duration and minimal peritoneal contamination, and especially in the presence of a perforated gastric ulcer, the definitive procedure of gastric resection, as advocated by Strauss[24] and Bisgard[3] might be considered the procedure of choice.

Hemorrhage is a complication of peptic ulcer which, in most cases, will respond promptly to medical therapy, and will not require surgery to stop bleeding. The most important element in such conservative therapy is blood volume replacement by whole blood transfusions. Repeatedly expressed views, such as those of Andresen,[2] indicating that blood transfusion will cause bleeding to continue or to start again, have no physiological basis. The free feeding of a bland diet, as advocated by Meulengracht,[20] seems to be preferable in these cases, whether the benefit is due to a diminution of hunger contractions in the stomach, prevention of the digestion of blood clot by gastric juice, or the correction of hypoproteinemia. It is important that blood dyscrasias be ruled out in such bleeding cases by appropriate laboratory procedures. Close observation of a patient with severe hemorrhage is essential; the response of the individual patient is best noted by frequent determinations of blood pressure, pulse, condition of the skin, and packed cell volume.[23] Since emergency surgery is always a possibility in cases with severe bleeding a definite x-ray demonstration of ulcer must be made. There is no objection, providing the patient is not in shock, to requesting a gastric fill up as an emergency. Initially, one swallow of heavy barium is given to rule out esophageal varices, and the stomach is then outlined with a thinner mixture. Palpation is, of course, contraindicated.

Despite all methods of conservative therapy, there are a certain number of patients who will bleed to death unless emergency surgery is instituted. If emergency surgery for bleeding is limited strictly to those cases with the so-called "fatal type of hemorrhage,"[12] the over-all mortality of bleeding peptic ulcer will be reduced. With modern anesthesia, blood replacement, and postoperative care, the mortality of such emergency procedures should be well below 10 per cent, provided the decision to operate is reached early in the course of the bleeding, as emphasized by Finsterer.[7] It is a matter

of fine clinical judgment to make an early decision as to which cases will require emergency surgery. Such a decision requires the combined acuity of the internist and surgeon. From various statistical studies,[6,8,13,23] we know that certain types of patients will be more likely to have the fatal type of hemorrhage. These include the following groups: 1. Those with large chronic ulcers, the fibrous base of which will not allow a bleeding vessel to retract. 2. Those with lesser curvature gastric ulcers, which usually erode the left or right gastric arteries or one of their main branches. 3. Those with posterior wall duodenal ulcers, eroding the gastroduodenal or superior pancreaticoduodenal arteries. 4. Patients over 45 years of age, who usually have a moderate degree of arteriosclerosis, which prevents contraction and retraction of the bleeding vessel. 5. Patients who fail to respond promptly to conservative therapy. The ultimate prognosis in such cases with continued conservative therapy will be poor.

The operation of choice during the bleeding phase is subtotal gastric resection, with removal of the ulcer, if feasible. Lesser procedures, such as ligation of vessels, cauterization, local excision of the ulcer, pyloroplasty, and gastroenterostomy, have not succeeded in controlling the bleeding, whether due to failure to attack the bleeding point itself, or due to the numerous vascular anastomoses in the gastric wall. Vagotomy has no rational place in the treatment of actively bleeding ulcer.

In the older age group, if bleeding is controlled by conservative means, elective operation is indicated to avoid a second hemorrhage which may well result in lethal exodus. Repeated hemorrhages from ulcer in the younger age group are an indication for elective surgery.

Pyloric obstruction often occurs as a result of the cicatricial contraction of a benign ulcer located in the neighborhood of the pylorus. Early partial obstruction may be due to pylorospasm or to edema surrounding the ulcer, and may be relieved by antispasmodics and intragastric suction. Later and more pronounced obstruction due to the constricting scar tissue of a longstanding ulcer can only be relieved by surgical means. These cases often manifest associated malnutrition, hypochloremia, hypoproteinemia, alkalosis, anemia, and avitaminosis, all of which must be corrected in so far as possible before definitive surgery is undertaken.

The type of operation to be employed for perforated ulcer, gastric ulcer, and actively bleeding ulcer is fairly well defined, but there is less agreement concerning the procedures indicated for uncomplicated duodenal ulcer, obstructing duodenal ulcer, or for duodenal ulcer which has caused severe bleeding at some previous time. The

most common types of operations employed are: (1) gastroenterostomy, (2) subtotal gastric resection, and (3) vagus resection. It might be wise to consider briefly, both from the physiological and clinical viewpoints, what one can expect each of these procedures to accomplish.

Gastroenterostomy will decrease the emptying time of the stomach, and will short-circuit an obstructed pylorus. It does provide neutralization of acid gastric secretion at the stoma by the alkaline duodenal juices, but, as pointed out in the thorough study of Holman and Sandusky,[14] the reduction in the acid secretory response to histamine is not marked. Gastroenterostomy of course fails to remove the ulcer or the ulcer bearing area. From a clinical point of view, gastroenterostomy is followed by a high incidence of jejunal ulcer, especially in young individuals with a high acidity.[15] The indications for gastroenterostomy would therefore seem to be limited to cases of pyloric obstruction in elderly individuals or poor risk patients, with atonic stomachs and a low acid response to histamine.

Subtotal gastric resection decreases the emptying time and provides neutralization of the remaining acid secretion at the stoma, as does gastroenterostomy. In addition, however, by removal of the lower three-fourths of the stomach, the acid secretion is directly affected, first by removal of the antrum, the seat of the hormone "gastrin," and secondly by removing a large proportion of the parietal cells. With an adequate resection, one can expect achlorhydria to histamine in approximately two-thirds of the cases.[28] Experimentally, subtotal gastric resection with a short afferent loop anastomosis protects against the histamine-induced jejunal ulcer.[19] With the exception of a few cases in which removal of the ulcer would jeopardize the common duct and surrounding important structures, subtotal gastric resection removes the ulcer as well as the ulcer bearing area. Finally, this operation combined with a short afferent loop anastomosis results in a minimal number of jejunal ulcers.[9] Such a procedure is certainly indicated for gastric ulcer and to stop severe bleeding from ulcer. It seems superior in cases of pyloric obstruction with considerable acid secretion, and to date is the most widely accepted procedure for uncomplicated duodenal ulcer. In an occasional case of perforation with minimal contamination, it may be justified, and, combined with the resection of the jejunal ulcer, is indicated for such an anastomotic ulcer resistant to vagotomy.

Vagus resection reduces the motility of the stomach, and therefore prolongs the emptying time.[22] It reduces in acidity and amount the acid secretion of the stomach, but not so greatly as gastric resec-

tion, since section of the nerves affects the cephalic and interdigestive secretory phases only. In this connection, one must recall the work of Vanzant,[25] indicating a return of acid secretion in dogs several years after vagotomy. Vagus resection reduces the secretion of alkaline mucus, and, by its prolongation of emptying time, may interfere with the normal regurgitative neutralization by duodenal juices. It removes neither the ulcer nor the ulcer bearing area. Vagotomy fails to protect against the experimental histamine-induced ulcer,[10] or the Mann-Williamson ulcer.[21] This operation, tried and discarded in European clinics 30 years ago, is still undergoing re-evaluation which will not be complete until results are studied over a period of many years. Dragstedt[4] reports uniform healing of all duodenal and jejunal ulcers after complete vagotomy, yet, recalling past experience with gastroenterostomy, it would seem unwise to accept simple vagotomy or combined procedures as the operation of choice until many years have elapsed. As far as transthoracic vagus resection is concerned, it seems irrational to treat an abdominal disease by a thoracic operation, never visualizing or palpating the site of the pathology. Vagus resection alone is certainly contraindicated in the presence of obstruction, and for gastric ulcer, not only because of the possibility of the unrecognized presence of carcinoma, but because, as Dragstedt[4] points out, the results in vagotomy for gastric ulcer are poor. For the present, then, during the trial period, general opinion indicates the desirability of limiting the application of vagus resection to cases of gastrojejunal ulcer, or the uncomplicated intractable duodenal ulcer. It is noteworthy that Healy and Sauer[11] have recently recorded a high percentage of failures of complete vagotomy for these two conditions.

In summary, the indications for operation for gastric and duodenal ulcer have been presented, and an attempt has been made, on the basis of known physiological and clinical data, to determine the type of operation which should be employed for each indication.

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PROBLEMS OF TREATMENT OF THE SEVERELY BURNED

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SINCE the abandonment of tannic acid therapy during the early years of World War II, emphasis on the general management of the severely burned patient during the acute stages has taken precedence over any form of local therapy. It is now well recognized, at least in hospital centers, that problems associated with acute burns are chiefly the result of shock, decrease in the number of circulating red cells, disturbed fluid and electrolyte balance, and impairment of nitrogen equilibrium. The most immediate concern of the surgeon should be the restoration of circulating blood volume to adequate levels and the relief of general tissue anoxia through the administration of whole blood, which is far superior to plasma even for initial fluid replacement. In spite of apparent hemoconcentration there is a loss of red cells from several possible sources: (1) destruction in the burn area; (2) fragmentation and increased fragility due to morphological changes produced by thermal injury; (3) stagnation in the dilated capillary bed; (4) and the so-called sludge phenomenon.

No formula for calculation of estimated blood and fluid requirements during the shock-edema phase of acute burns is as effective as sound clinical judgment based upon careful observation of the patient. It is our general practice to give one or two liters of blood during the first 12 hours in the case of an adult patient with the amount and rapidity of administration dependent upon the degree of shock. The best index of adequacy of therapy is maintenance of the urinary output at 25 cc. per hour or more. At the same time, a modified Haldane's solution is given orally in as large amounts as can be tolerated by the patient (3 Gm. NaCl and 1.5 Gm. $NaHCO_3$ per liter of distilled water). Moyer[1] has clearly pointed out the fallacy of allowing ordinary drinking water which produces water-intoxication with its attendant symptoms of nausea, vomiting, restlessness, delirium, muscular twitchings, convulsions, etc. Now that improved laboratory methods are at hand, it is easy to demonstrate lowering of serum sodium levels and correspondent elevation of potassium, even to toxic levels, during the early critical period.

At the end of 12 hours the patient's condition should be re-evaluated on the basis of appearance, temperature, pulse, urine volume and specific gravity, red count, hemoglobin, and hematocrit.

Presented during the Denver Assembly of the Southwestern Surgical Congress, Denver, Colorado, September 25-27, 1950.

If the hematocrit is over 50 and the patient still shows signs of shock, transfusions should be continued along with the alkaline buffered solution by mouth. Patients who are unable to take fluids orally at first can usually begin after an infusion of 500 cc. of Ringer's solution. We rarely find it necessary to give other intravenous fluids during the first 48 hours following injury.

There has been a tendency within recent years for the local treatment of burns to become more and more simplified. The standard treatment in most hospital centers at present includes chiefly fine-mesh grease-gauze, rayon moistened with saline, or isotonic Dakin's solution wet dressings applied directly over the burned area and covered with a large bulky pressure dressing. We have felt that for proper care, patients should be dressed by so-called burn teams in the operating room under light analgesia and have employed for this purpose large strips of Furacin-impregnated gauze and standard burn dressing rolls which can be easily removed by flushing with large quantities of normal saline and quickly re-applied with a minimum of exposure and trauma to the part. With evidence of infection we have employed wet dressings, using a solution of 1:4000 zephiran and ¼ per cent acetic acid in normal saline injected through Dakin tubes.

The open-air or exposure treatment of acute burns, which has been advocated by A. B. Wallace and M. J. Kyle of the University of Edinburgh,[2] while perhaps revolutionary at the present time, appears to have great promise. Pulaski has treated over 100 patients by this method,[3] and we have had, ourselves, clinical experience in 90 cases of severe burns. We feel that our results justify wide clinical trial in the hands of many operators in view of its applicability for mass treatment of large numbers of burned patients where obviously there would be neither time, material, nor personnel to apply pressure dressings properly. The method is most useful for burns which are largely confined to one surface of the trunk or extremities either front, back, or side and to the head and neck. We prefer to put involved hands up in the position of function with pressure dressings for the first 48 hours to minimize initial edema. Thereafter and for other parts of the body from the beginning of therapy, our general procedure is as follows:

Acutely burned patients are stripped of clothing and placed on sterile sheets in the open ward without debridement or opening of blebs. Extremities which are involved are kept constantly elevated, using mechanical devices if necessary. Within 48 to 72 hours thin crusts form over the raw surfaces and these are allowed to remain untouched as long as they are perfectly dry. If the burn is only second degree, they will scale off eventually with complete healing underneath. If there are third degree burns, usually some liquefaction appears at the periphery of the dry slough in about 14 to 21 days, at which time the

Fig. 1-a.

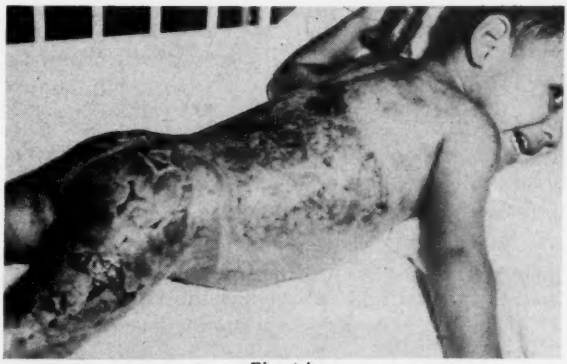

Fig. 1-b.

Fig. 1-c.

Fig. 1. Child admitted 10 days following severe burn. Dressings were discarded, and the moist necrotic tissue was allowed to dry out by exposure. Since burns of the back were obviously third-degree the slough was excised 2 weeks later and skin grafts were applied. 1-a. View on removal of dressings. 1-b. View 3 days after exposure. 1-c. View following application of skin grafts.

slough is excised and the area is covered with a single layer of gauze. Patients on the open air treatment are given the same general therapy with blood and oral alkaline fluids as mentioned above. It has been our practice to use chemotherapy for five days in the form of penicillin or terramycin. We have, like Wallace and his co-workers, noted that fewer of our patients require grafting; healing occurs in much shorter time than with the use of pressure dressings; the period of temperature elevation is decreased; blood and protein requirements are less; and the length of hospitalization in the average case is considerably shortened.

During the recovery phase of acute burns, which begins as shock and edema subside, measures must be taken to avoid cardiac, pulmonary, and renal embarrassment by overburdening the patient with fluids. Oral alkaline fluids are discontinued and tap water is substituted for drinking purposes. As diuresis occurs, sodium is mobilized and following rapid excretion of potassium through the kidneys, the patient may actually suffer from potassium deficiency and must be treated accordingly. If there is evidence of renal insufficiency, the total fluid intake is restricted to the amount of urinary output plus estimated insensible water loss.

To combat negative nitrogen balance, which presents an inevitable problem until healing occurs or raw surfaces are covered by skin grafts, we have found that forced feeding by means of an intragastric tube assures the patient of a high caloric diet with 300 to 400 grams of protein every 24 hours. For this purpose we employ a small plastic tube which has the caliber of an 18 gauge needle. It is easily inserted (when stiffened with 70 per cent alcohol) and may be left in place indefinitely without inconvenience to the patient even when eating solid food. We have devised a pump which delivers the whole mixture containing milk, eggs, dextrose, and Protolysate from a vacuum bottle reservoir at a constant rate of speed without danger of clogging of the tube. Forced feeding is continued until the patient is able to take enough food orally of his own volition to approximate his nitrogen requirements.

For the prevention and treatment of anemia, blood transfusions are continued during the recovery period, if necessary, or in preparation for grafting.

Chemotherapy is important for the first few days of acute burns; thereafter we believe it should be discontinued except in rare instances where there is an overwhelming infection. We have noted that with prolonged use of antibiotics there is often a tendency for the patient's temperature to remain elevated beyond the usual period.

During the recovery phase and throughout the entire convalescence of the patient, it is extremely important to recognize the

Fig. 2-a.

Fig. 2-b.

Fig. 2-c.

Fig. 2. Patient admitted with severe burns of face, chest, arms, and hands 5 days following injury in toxic state. Dressings were discarded and healing was spontaneous except for third-degree burn in flexion crease of neck. 2-a. View on admission. 2-b. View 1 week later after subsidence of edema. Entire burn areas have become dry. 2-c. Appearance on discharge 35 days later with small raw area in flexion crease of neck.

factor of psychic trauma and to insist that all medical and nursing personnel participate in measures which will help the patient's morale.

Complications in treatment of severely burned patients are more common than in former years, largely, we believe, because many patients with extensive burns live longer than previously, before the institution of transfusion therapy. Cardiac and pulmonary complications occur frequently and there is a high incidence of thrombophlebitis. During the past two and one-half years we have seen 10 cases. It has been suggested[4] that sodium:potassium imbalance may be responsible for disturbances in the mechanism of thrombin destruction. Certainly we have not felt that anticoagulant therapy is of much value for prevention of peripheral circulatory complications. There is evidence of liver damage in almost every patient with severe burns as indicated by the standard function tests; with the use of high carbohydrate diets and high protein supplementary feedings, however, we have felt that toxic changes in the liver are more readily reversible than in former years.

One frequent complication of burns in the present regime of treatment is the development of ulnar and peroneal palsies as a result of prolonged use of pressure dressings even when every care is taken to prevent their occurrence.

Infection is always a factor to be considered in serious burns. We have found that patients treated with the open air method, exposed to the contaminated air of a general ward, have less infection than others treated by closed technics with all sterile precautions. The flora in both cases is probably the same. It is possible that the warm, moist, raw surface of a burn covered by dressings may serve as a more fertile medium for bacterial growth than a cool, exposed, dry surface. At the present time infection seems to be unavoidable but we feel that it may be minimized by keeping patients in as good nutritional state as possible and by applying grafts as early as feasible after demarcation and excision of the slough, within 14 to 21 days after injury is possible.

Grafting in severely burned patients presents a number of problems. Since early coverage is so important, it is best to disregard cosmetic considerations initially. Grafts should be cut as thin as possible for the best take; a backing of rayon coated with dermatome glue allows them to lie flat on the recipient areas without the use of sutures. The problem of permanent take of homografts appears to have no immediate solution; nevertheless an occasional "take" *is* reported and we, ourselves, have had one such experience.[5]

Experimental work is in progress regarding the basic theories for homograft dissolution; but even so there should be a wider clinical use of homografts with careful records made of all possible factors concerned.

During the interval between grafts, the intensity of general supportive therapy should not be lessened. Careful attention must be given to blood and protein requirements since the patient is likely to be in worse condition at the time of the second and subsequent grafting procedures than he was at the first. Definitive treatment should be delayed until the individual has had rehabilitation with regard to walking and the use of his hands; has gained weight and strength; and is mentally prepared for tedious reconstructive surgery.

One of the problems which often confront the surgeon in a hospital center is the treatment of burned patients who have had inadequate therapy elsewhere. After the patient has been burned for a considerable period of time he is usually in a state of severe malnutrition, anemia and negative nitrogen balance. Needless to say, no surgery should be attempted until he is put in the best possible physical condition. Where severe contractures and other deformities exist a plan of procedure must be worked out to take in account, first, the relief of functional deformities and, second, the repair of disfiguring scars.

The unsolved problem in the treatment of severely burned patients is the question of handling large numbers of patients with a minimum of personnel and a maximum of efficiency. We are all war-and-disaster-conscious and realize that in the event of atomic warfare the great problem will be the treatment of large numbers of flash burns. Work is going ahead in the development of plasma substitutes. To date dextran, which was developed in Sweden, appears to be the most satisfactory solution. Its proponents[6] claim that it may be used to supplant plasma in restoring circulating blood volume and that it has the advantage of being easily stored for long periods of time of producing few systemic reactions. If the open air method proves satisfactory, local therapy will be greatly simplified during the acute stages of burns. For mass treatment the proper oral fluids can be easily prepared with the use of sodium bicarbonate and salt tablets. Any plan of treatment, however, must depend upon careful organization for handling of disaster victims and a knowledge on the part of physicians of the underlying pathology and physiology of severe burns.

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CHRONIC LEG ULCERS*

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THE persistence of leg ulcers usually denotes neglect or inadequate treatment. Not only are they a source of discomfort, disability and a disagreeable odor, but occasionally amputation of the extremity is necessary for relief. A better understanding of the etiological factors and superimposed conditions will promote a more effective management of these lesions.

The first and most important consideration is the integrity of the blood supply to the afflicted extremity. Whatever was the initial cause loses much of its significance once chronicity is established. Other factors must be recognized, but once persistence and recurrence is established, the primary deficiency is the loss of adequate blood circulation in that portion of the extremity. This relationship has been recognized for as long as the term "atrophic ulcer" has appeared in the literature. The greatest barrier to the effective management of leg ulcers is the surgeon's disregard or inability to recognize certain mechanical impediments to a good and adequate blood supply.

Foremost among the causes of leg ulcers is varicose veins. When they are large, dilated and tortuous, these veins are easy to recognize. This is particularly true in thin individuals where the veins are relatively more superficial. In large or obese individuals the detection of abnormal veins is sometimes difficult. The small saphenous vein and incompetent perforating veins are most often overlooked and their presence can materially contribute to a poor venous return. The stagnation of fluid which results from these veins reduces the local tissue's resistance to infection and trauma. Edema of the ankles usually supersedes the ulcer. Frequently there is an eczematoid dermatitis of the skin. Many times there are large venous channels about an ulcer, and sometimes these pass beneath the ulcer bed. They are often difficult to identify because of the firmness of the tissue about them. Their detection requires a delicate sense of touch. If one can palpate a distended vein above and below an area of ulceration and scar, perhaps continuity can be determined by percussing one segment lightly and eliciting the pulsations in the other segment.

Ulcerations attributable to arterial disease and arterial insuffi-

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Presented during The Southwestern Surgical Congress Assembly, Denver, Colo., September 25-27, 1950.

ciency are found most commonly on the toes and feet. Occasionally they develop on the leg as result of trauma. Other signs of arterial insufficiency are usually present. There is a loss of demonstrable arterial pulsations in the distal portion of the extremity; the feet are cold and moist and the skin is shiny and atrophic. Diabetes, Buerger's Disease, arteriosclerosis and arteriolosclerosis are prominent causes of arterial insufficiency. Occasionally a large hemangioma of the extremity may so embarrass the circulation in an area as to produce an ulceration. The successful treatment of one such case, a nevus flammeus, has been reported by the author and John Powers Wolff.[1]

Other precipitating factors should be considered. Ulceration may be caused by squamous cell carcinoma. Syphilis produces leg ulcers with copious exudates that rival those of varicose ulcers. Syphilitic ulcers are more likely to occur in the upper part of the leg and to be multiple. Tuberculosis may produce leg ulcers. They are usually bilateral and have a characteristic appearance. Mycotic ulcers occur more frequently than suspected. A characteristic "musty" odor is ascribed to these. Blastomycosis is the most common offender. Actinomycosis and sporotrichosis are other mycoses capable of producing leg ulcers. Bromism and sickle cell anemia are sometimes manifested by leg ulcers.

Diagnostic procedures should include biopsy, blood Wassermann test, TBC patch test, chest roentgenograms, Benedict's test for sugar in the urine, smear and culture of the exudates, and particularly a culture on Sabouraud's media.

One of the most common mistakes in the management of leg ulcers is emphasis placed on the role of infection without consideration of the underlying factors which contribute to the poor resistance of the tissues. Infection may be of great importance in acute leg ulcers, but in the chronic variety its role is diminished. This accounts for the inefficacy of various ointments, antibiotic or protective, that have been applied to leg lesions.

A vitamin deficiency may also account for the poor resistance of the tissues and the diminution of a blood supply. This is particularly true if the superficial damage is proportionately greater than that in the deeper layers. An eczema-like dermatitis and the desquamation of skin should lead one to strongly suspect vitamin deficiency. In some cases, an adequate diet reinforced with nicotinic acid alone have completely healed ulcers of long standing.

Despite the fact that specific agents may have precipitated the initial lesion, certain changes in the tissue turgor perpetuate the ulcer. These changes are the result of the body's attempts to heal the

ulcer by successive periods of fibroblastic proliferation. The ensuing fibrosis has narrowed the vessel lumina and reduced the extracellular spaces. Contraction of the collagen fibers has further reduced the pathways of the circulating fluids. After a few years fibrous changes may be so extensive as to render impossible a spontaneous healing of the ulcer. This phenomenon is particularly conspicuous with ulcers that have been treated with x-ray or ulcers resulting from the trauma of a fracture. The tissue changes may be so widespread as to involve the deeper skin layers for a considerable distance around the ulcer, and the muscle fascia. Sometimes this results in a narrowing of the extremity at this site and embarrassment of the distal circulation. Examination of these patients reveal the skin to be of a leathery consistency for a considerable distance away from the ulcer, and in some instances to extend completely around the leg. The depth of fibrosis is often proportionate to extent of superficial thickening. Atrophy of the skin and palpable firm induration of the subcutaneous tissues are evidences of local ischemia.

Treatment

The treatment of chronic leg ulcers should first be directed towards improvement of the blood supply to the affected extremity. This may be done in accordance with abnormalities discovered on examination. If it is suspected that a moderate degree of vessel sclerosis is present, as occurs in patients with Buerger's disease, diabetes and arteriosclerosis, a sympathectomy might improve the circulation by releasing vasospasm of the collateral vessels. This may also be true if considerable scar tissue is present, or if a low grade infection is present in the ulcer. If varicosities are present, an effort should be made to appreciably reduce their number and relieve the circulatory stagnation. This can be accomplished only by a diligent search for the incompetent vessels; and it is important to secure all of the tributaries of the great saphenous vein at the fossa ovalis. Occasionally a large ulcer has a dilated vein just above or beneath it.

Following measures to improve the general circulation to the extremity, effort should be focused on local treatment. Excision of the ulcer together with surrounding scar tissue will result in good vascular bed, or at least, the best that can be obtained. A skin graft to cover the defect may then be applied, either at the time of excision or later when a good bed of healthy granulation tissue has formed. Occasionally, during the excision of the ulcer, it may be necessary to do a fasciotomy in order to relieve constriction of leg by scar tissue.

Summary

Factors predisposing to the perpetuation of leg ulcers have been

presented. Foremost among these are impediments to a good and adequate blood supply to the entire extremity. Improvement of the circulation must be effected before local measures are adopted to eradicate the ulcer.

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UNUSUAL GASTROINTESTINAL FISTULAE

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THE object of this paper is to bring to attention a few unusual types of fistulae which may occur in the gastrointestinal tract. Many of the unusual fistulae which occur are formed by nature; however, there are occasions when surgeons can also form rather unusual fistulae.

INADVERTENT GASTROILEOSTOMY

The first type which I am going to describe is that which arises due to the surgeon's error in anastomosing the stomach to a lower portion of small intestine in the performance of a gastroenterostomy or in the performance of a gastric resection. Dr. Wm. H. Moretz,[1] in *Annals of Surgery,* July, 1949, reviewed the literature on inadvertent gastroileostomy and found that there were a total of 24 cases of gastroileostomy found in the literature up until that time. Out of the total of these 24 cases, only 2 were associated with a partial gastrectomy. The other 22 were all encountered when a gastroenterostomy had been done. Because of the apparent rarity of an inadvertent gastroileostomy following a gastric resection, I feel that the following case is justified, as it represents apparently the third case in the literature in which a gastrectomy done for peptic ulcer was done in which the stomach was anastomosed to the terminal ileum.

This patient was a 37 year old white male, admitted to the hospital on July 21, 1949 with a chief complaint of diarrhea and vomiting. The history of his present illness goes back to around 1943, when in service he developed stomach trouble, and in 1944 was diagnosed as having a peptic ulcer and was medically discharged from the service. He continued to have epigastric pain and vomiting; and in March, 1949 was operated on in a private hospital in California, supposedly to have his appendix removed. Following this operation, his abdomen was opened a few days later for further surgery and the surgeon at that time stated that he had removed nearly two-thirds of his stomach because of a duodenal ulcer. He remained hospitalized for 25 days, during which time he received no food by mouth and was given intravenous solutions daily. He was then transferred to a V. A. hospital, where he remained for about three weeks and was immediately given a bland diet, but then began to vomit and developed a diarrhea. He was discharged about 15 or 20 days after entry, but because of the diarrhea and vomiting was rehospitalized for five weeks, being discharged on June 22, 1949. Since his discharge he

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Presented during the Denver Assembly of The Southwestern Surgical Congress, Denver, Colorado, September 25-27, 1950.

continued to have a diarrhea, the stools varying from watery to loose and having as many as 10 to 20 a day. For the past several days he had been vomiting and the vomitus smelled fecal in odor. He stated that after he was started on food he had eaten as many as six eggs for breakfast and as many as six or seven fried eggs and two cans of oysters for supper, but this food apparently went through him without being digested, as he had continually gone downhill, stating that he had lost approximately 50 pounds since the time of surgery. He stated that the food apparently passed through him in about 20 minutes. He had no history of hematemesis or melena, and had been taking amphojel, as prescribed by his physician.

The physical examination showed a very poorly nourished young adult male, appearing to be chronically ill. There was very obvious evidence of avitaminosis, as seen by the examination of the mouth and tongue. The rest of the physical examination was essentially normal, except for the abdomen which revealed a right rectus scar approximately 7 inches long.

Fig. 1. Gastro-ileostomy performed for duodenal ulcer.

The laboratory examination revealed a normal urine. The red blood count was 4,000,000 and hemoglobin 11.6 Gm. The white blood count was 4,500 with a normal differential. Gastric analysis revealed total acidity of 9.6 and a free hydrochloric of 0. A stool examination showed 4 plus occult blood, and the total protein 6.3 Gm. with the albumin 4.55 and the globulin 1.75. Gastrointestinal series done showed an anastomosis between the stomach and the terminal ileum, with only about 18 to 20 inches of small bowel being visualized. The barium apparently almost immediately passed into the large bowel, and there appeared to have been some type of gastric surgery done previously. A barium enema done showed the barium to enter the ileum and apparently go into the stomach.

Surgical exploration was carried out on Aug. 11, 1949. Exploration revealed that he had had a very low type of gastric resection performed and the terminal ileum had been anastomosed to the stomach about 18 to 20 inches above the ileocecal valve. The gastroileostomy was taken down and about 6 inches of ileum were resected. An end to end anastomosis of the ileum was done. Because of the inadequacy of the resection, a reresection was performed and a very short loop anterior Polya anastomosis was done, with a total of two-thirds of the stomach now being resected. Surprisingly enough, there did not appear too much reaction around the anastomosis between the stomach and the ileum, even though 4 plus occult blood had been found in the stools. The patient made an uneventful recovery and left the hospital 14 days following surgery. Since leaving the hospital he has been gaining weight steadily and has had no gastrointestinal symptoms.

Gastrocolic Fistula from Carcinoma of the Stomach

Although most gastrocolic fistulae arise as a consequence of gastrojejunal ulceration following performance of some gastroenterostomies done for peptic ulcer, another less frequent cause is malignancy of the stomach or colon, with subsequent development of a fistula. Symptoms which arise in such an event are those produced earlier by the malignancy and later when the fistula develops as a result of extension of the malignancy to the colon or stomach with necrosis apparently producing the tract. The onset of the latter symptoms may be rather insidious and are those of: first, diarrhea, which is usually progressive; secondly, eructation or vomiting of fecal material; third, rapid weight loss; fourth, epigastric pain; and fifth, nutritious effects, such as avitaminosis.

The next case represents an example of a gastrocolic fistula developing as a result of malignancy of the stomach.

This patient was a 58 year old white male, admitted to the hospital on June 1, 1949 complaining of some soreness in his stomach, weight loss, and recent diarrhea. He stated that he had been suffering from stomach trouble since about 1947 and had had several gastric hemorrhages in the past. Physical examination revealed a rather well developed, elderly white male, not appearing to be acutely ill. Examination was essentially negative, except for moderate tenderness and slight muscle guarding in the epigastric area.

Laboratory examination showed a 2-4 plus occult blood in stool. The red blood count was 3,400,000 and hemoglobin 6.6 Gm. The white cells were 9,000, with a normal differential. The gastric analysis revealed total acidity of 6.5 with a free hydrochloric of 0. The total proteins were 6.40 Gm. A gastrointestinal series done shortly after admission revealed a fistulous connection between the stomach and the colon, arising apparently because of a carcinoma of the stomach which appeared to be rather extensive. A barium enema was reported as having gone directly into the stomach, and the patient eructed a small amount of barium immediately following the enema.

He was explored on June 22, 1949 and an extensive malignancy of the stomach was found which had plastered itself against the liver, and the colon was also found to be adherent to the mass in the stomach in the prepyloric

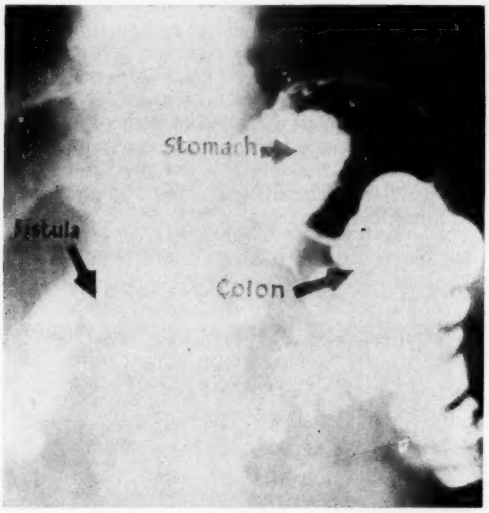

Fig. 2. Gastrocolic fistula (from ca. of the stomach).

area. The entire mass was firmly fixed and no surgical procedure was deemed advisable. A carcinomatous implant was removed from the region of the round ligament and the wound was closed. This patient continued to go downhill and expired on August 6, 1949, approximately six weeks following surgery.

Benign Duodenocolic Fistula

The next type of fistula which I am going to describe is the benign duodenocolic fistula, which apparently is a lesion of extreme rarity. Quite a number of cases are encountered in the literature of a fistulous connection between the duodenum and colon secondary to a malignancy, but a mere handful of benign fistulous connections are to be found. Rees,[2] in 1933, reported on a case of duodenocolic fistula which he believed to arise from an ulcer in the colon due to typhoid fever. Bargen,[3] in 1939 reported on a case of colo-gastric and colo-duodenal fistulae secondary to thrombo-ulcerative colitis. McPeak,[4] in 1940, reported on 2 cases and emphasized that the etiological factor was most likely a perforating duodenal ulcer into the transverse colon. McClinton,[5] in 1944, reported on a case which followed a ruptured duodenal ulcer into the transverse colon. Recently, Sir Henege Ogilvie,[6] in presenting a paper to the Southern Surgical Association in December, 1949, reported on 2 additional cases, both of which he thought were secondary to a tuberculous

process. Lyons[7] has also recently encountered a duodenocolic fistula as a complication of a duodenal ulcer, and Crile[8] recently has also encountered a case which he thought was due to an old mesenteric tuberculosis. From the relatively few reports which are found in the literature, there have appeared several possible etiological factors; namely, duodenal ulcer, typhoid fever, tuberculosis, and ulcerative colitis; the preponderance of opinion apparently being that a duodenal ulcer is the most frequent cause of a benign duodenocolic fistula. A total of only 9 cases have been found, both in the literature and from personal communications, since 1885. All of these have been proven, either at surgery or at the autopsy table. In reviewing the case histories of the cases reported, they all seem to follow about the same symptom complex; namely, persistent diarrhea, weight loss, avitaminosis, and occasional vomiting. After operative repair of the fistulous tract, the results are quite striking and most gratifying.

This patient was a 68 year old white female, admitted to the hospital on Sept. 29, 1949 complaining of nausea and vomiting of three days duration, associated with fever and a sore throat. She stated that during the past month she had also had two attacks of severe diarrhea which had since abated. Her past history revealed that at the age of 19 she developed chronic gastrointestinal complaints of indigestion, gas, cramps, and diarrhea. These gastrointestinal complaints would occur usually during the summer. At the age of 45 she stated that she developed the "flux" while caring for relatives with the same trouble, and was in bed for one month and was weak for three months following. With this illness she had severe bloody diarrhea and severe abdominal cramps. She stated that following this illness whenever she took a laxative she passed blood in small amounts, and so she discontinued this practice. Since her illness at the age of 45, she had noted that about one or two times a month she had attacks of sharp epigastric pain associated with nausea and vomiting, and the vomitus had a very disagreeable taste and odor similar to feces. She also noted that considerable food seemed to pass through her gastrointestinal tract undigested. Several times a year she had suffered with severe attacks of diarrhea and had had two such episodes in the past month, one lasting a week and the other several days. Recently she had lost some weight, but she stated that she had never weighed much more than 105 to 110 pounds during her life.

Physical examination revealed a thin, dehydrated, white female of 68, appearing to be acutely ill and vomiting at frequent intervals. Her tongue was beefy red and her mouth showed evidences of avitaminosis. Examination of the chest revealed rales at the left base. The rest of the physical examination was essentially negative.

Her white blood count on admission was 22,000 and she showed a moderate anemia, having 3,170,000 red cells with 68 per cent hemoglobin. A gastrointestinal series showed a fistulous connection between the second portion of the duodenum and the colon near the splenic flexure. This was also demonstrated by means of a barium enema. X-ray of the chest revealed either a

chronic pneumonitis of her left base or a metastatic involvement. There was a small amount of fluid at the left base, and a Papanicolaou smear of an aspiration was negative for any malignant cells.

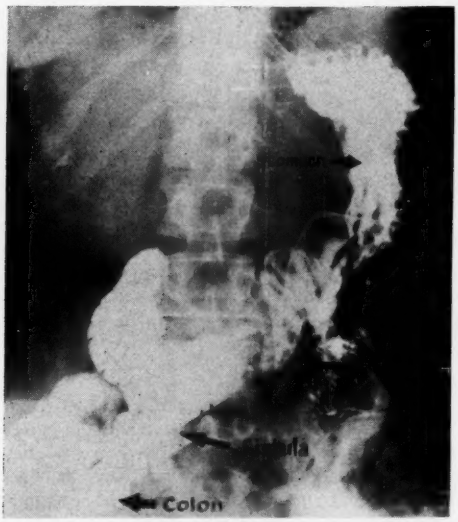

Fig. 3. Benign duodenocolic fistula (Gastrointestinal series).

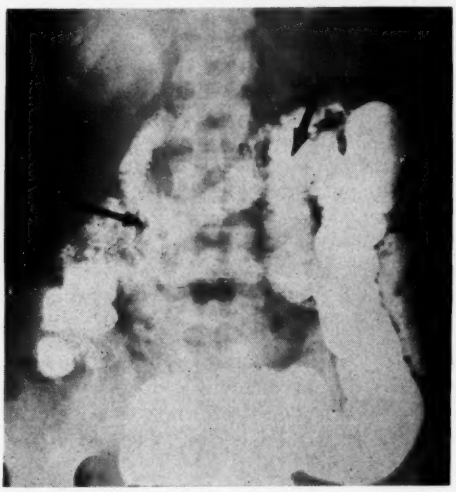

Fig. 4. Benign duodenocolic fistula (Barium Enema).

She followed a febrile course and was treated by antibiotics, intravenous fluids, blood transfusions, and general supportive measures. Her chest cleared somewhat, but there remained the possibility of there being metastatic involve-

ment in the left lung. Her temperature, which had been running as high as 102 and 103 F. on admission, gradually subsided and she was prepared for surgery.

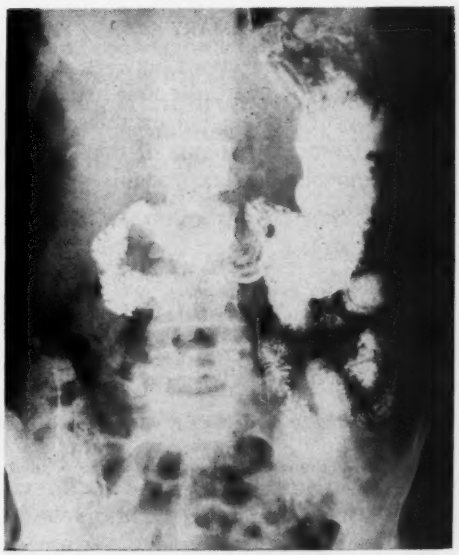

Fig. 5. Normal Gastrointestinal series following repair of duodenocolic fistula.

On Oct. 25, 1949, nearly a month after her admission to the hospital, she was explored through an upper right rectus incision, and a fistulous connection between the second portion of the duodenum and the colon near the hepatic flexure was encountered. This fistula measured about ¾ cm. long and about ½ cm. in diameter. The tract was divided between clamps and the opening in the duodenum and colon closed with three layers of sutures.

Following surgery she made an uneventful convalescence and left the hospital on the seventeenth postoperative day. She has had no gastro-intestinal symptoms since and has picked up considerable weight, weighing 108 pounds when last seen, and she appears to be in good health.

What the exact etiological factor is in this case is rather hard to prove. The diarrhea which she had at the age of 45 may very well have been typhoid fever and led to the subsequent development of the fistula. Another possible cause which has to be seriously considered is a duodenal ulcer, because she has had gastrointestinal complaints since the age of 19. We also considered the fistula could have arisen as a result of a perforating diverticulum of the duodenum. The intermittent diarrhea which this patient had for years was probably due to the fistula opening at times and then closing, because the diameter of this fistula was not very large. This case

was very simple to cure and the result has been most gratifying. Other authors have commented on the ease with which the fistulous tract is closed.

Summary

Three types of fistulous connections between the upper and lower gastrointestinal tract are reported, the first being a gastroileostomy secondary to operation for duodenal ulcer, the second being a gastrocolic fistula resulting from a carcinoma of the stomach, and the last being a benign duodenocolic fistula, probably as a result of typhoid fever or a duodenal ulcer.

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CERVICAL SPINE NERVE ROOT PAIN*

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ROOT pain having its origin in the cervical portion of the spinal column may present itself in many forms. The presenting complaint may be pain in the upper extremities, shoulder, shoulder girdle, interscapular area, precordial area, postauricular, occipital, frontal or postorbital regions. The structure of the cervical vertebrae, the spinal canal and its contents is such that relatively mild changes will produce nerve root irritation. The author[4] recently reviewed the literature and presented a series of cases in which the causes were enumerated. The common cause was found to be degenerative joint changes—61.8 per cent of the cases falling into this group. More recently, Jackson reported abnormal motion or subluxation of the apophyseal joints to be the most common cause. In 1949, Josey[2] reported 20 cases of occipital, postorbital and frontal headache in which he attributed the cause to pathology in the upper cervical spine.

There are several anatomical characteristics of the cervical spine that make it more susceptible to trauma than either the thoracic or lumbar regions, and the end result of such trauma is more marked. The bodies of the lower five cervical vertebrae have uncinate processes on each superior lateral border that form a shallow U-shaped superior surface. This articulation has a corresponding concave surface of the adjacent vertebrae. The processes give the intervertebral joint lateral stability but not anterior and posterior stability. The latter is dependent entirely on the apophyseal articulations. These joints are placed in the lateral plane with a forward-superior inclination so as to prevent forward subluxation. The plane and angle of inclination in these joints allows free flexion, extension, and lateral motions but cannot allow rotation. All of the rotation takes place in the superior two joints (occipito-allantoid and allantoaxial). The inability for rotation in any of the lower cervical vertebrae increases their susceptibility to strain. The articular process forms the posterior wall of the intervertebral foramen while the pedicles and posterior-lateral portions of the bodies form the superior, inferior and anterior walls, respectively. The plane and inclination of the articular facets are such that flexion increases the size of the foramen and extension decreases it (fig. 1). The latter may be sufficient to produce momentary compression of the nerve

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Presented during the Denver Assembly of The Southwestern Surgical Congress, Denver, Colorado, September 25-27, 1950.

root when the hyperextension is sudden and forced. The spinal cord and nerve roots more nearly fill the canal and foramen than in either the thoracic or lumbar regions. The nerve roots, by virtue of their leaving the cord at right angles and passing directly into the intervertebral foramina, have very little mobility. This makes them more susceptible to injury.

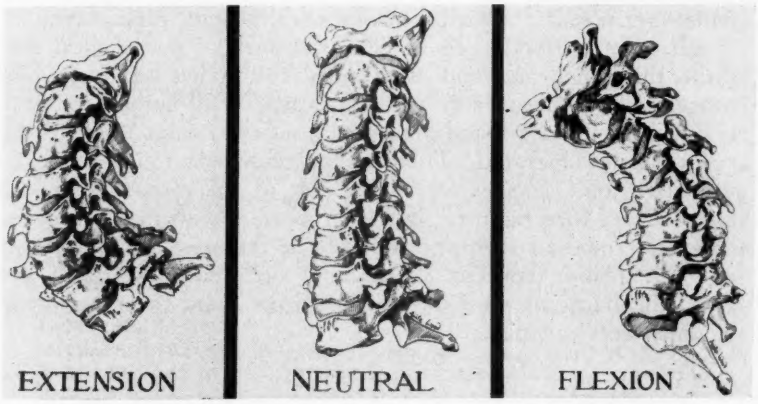

Fig. 1. Diagrammatic drawing showing the changes in the size of the intervertebral foramina with the neck in flexion, neutral and extension.

Anatomical variations, such as absence of the uncinate process, or asymmetry in plane, angles of inclination, size, and shape of the articular processes may produce sufficient instability to make these cases even more vulnerable to trauma. A study of 36 cadaver specimens by the author revealed asymmetry in the articular processes in eighteen that was of a sufficient degree to produce irregular motion. These changes were confined to the second and third articulation with the exception of 2 cases in which lower vertebrae were also involved.

Cervical radicular pain may be produced by any lesion that produces momentary or continuous encroachment on the nerve root before it leaves the canal, during its course through the foramen, or by reflex pain resulting from irritation of the apophyseal capsular nerves. It has been definitely found that the capsules of these joints are richly innervated. Damage to the capsule, such as sprains or strain, will produce stimuli to the sensory nerves which are carried to the central nervous system and produce pain that is referred through the dermatomes of the involved nerves. Mild injuries, such as snapping, or other sudden motions of the head, may initiate the symptoms. This is particularly true of the occipital headaches asso-

ciated with anomalies of the second and third cervical articulations. The majority of the patients will not be able to recall any injury without the most detailed questioning. However, years later, usually after the age of 40, symptoms will appear. Complete studies at this time will reveal the pathology. The large percentage of this group will reveal some degenerative joint changes (Table I). These

TABLE I

CAUSES OF CERVICAL RADICULAR PAIN—186 CASES

CAUSES	*Number of Cases*	*Average Age in Years*
Degenerative Arthritis	112	52
Herniated Nucleus Pulposus, Tentative	7	48.6
Congenital Anomalies		
21 involved the second and third articulation	29	37
Scalenus Syndrome	7	37.4
Neuralgia—X-rays and clinical findings negative	3	38.7
Acute Springs—Negative X-ray findings	23	31
Chip Fractures Apophyseal Joints	5	36.6

TABLE II

FINDINGS IN 36 CADAVER SPECIMENS

Average Age		65
FINDINGS:		
Generative Arthritis		28
Vertebral Bodies involved	26	
Apophyseal Joints involved	20	
Variations in Apophyseal Joints		18
All involved C_2-C_3 and two involved other joints		
Protrusion of Intervertebral Disk (Small Central Protrusion)		1
Large Epidural Vessels		2
Normal		4

changes may be localized to a single joint, but more frequently they will be multiple. When such changes are complicated by a herniated nucleus pulposus, the nerve root compression is greater and the symptoms more localized and more pronounced. Several authors[1,5,6] have felt that the herniation alone is the cause of the root pain in most of the cases. Table I reveals that our experience has been quite different. We could make a tentative diagnosis of a herniated nucleus pulposus in only 7 cases. One of these underwent surgery later, but no herniated disk could be found. The cause of the nerve root compression was found to be a large osteophyte projecting into the intervertebral foramen. A study of 36 cadaver specimens as shown in Table II revealed one small central herniation, but not a single lateral one.

The usual presenting picture is fairly uniform. The pain will be of a segmental type. It may have come on spontaneously on awakening in the morning, or after holding the head in a certain position for some time, but usually the patient gives a history of soreness in the neck or occasional "cricks" over a long period of time. Then some trivial injury, such as looking up suddenly or turning, or snapping of the head will be followed by pain referred to a localized area. The location of the pain will be determined by the dermatome involved. The symptoms may be brought on or exaggerated by certain motions, such as holding the head in certain positions as in ironing, sewing, working over one's head, or long drives in an automobile. Most patients complain that they suffer most discomfort at night, often getting out of bed for relief. Investigation usually reveals a poor sleeping posture that is caused by using a high pillow. Mild activity will be accompanied by partial relief of pain in practically all cases. Headache frequently complicates the other pain. This may be of two types. The first type is located in the postauricular, or occipital area. It is produced by some derangement in the articulation between the second and third vertebrae that has irritated the third cervical nerve root. The second type is postorbital and frontal. This type may accompany the involvement of any of the cervical nerve roots. These headaches are fairly typical of migraine, but respond well to treatment of the cervical spine. This is indicative of some irritation of the carotid sympathetic nerve plexus. It has been established that sensory fibers to the cervical sympathetics arise from each of the cervical nerves, but it is thought that no motor fibers arise from any of the cervical nerves. Therefore, one would propose the theory that sensory stimuli which arise in the irritated nerve root follow the pathways from the cervical nerve roots to the periarterial nerve plexuses of the brain by way of the sympathetic chain.

The physical findings depend on the degree and extent of the nerve root compression. There will be tenderness localized to the involved nerve roots. For example, the group with occipital headache will have tenderness over the third cervical nerve root; while numbness, or pain in the thumb will be accompanied by a tender sixth nerve. The segmental pain can be reproduced by pressure over the tender nerve root. There may be localized muscle spasm and tenderness. This is usually associated with trigger point tenderness. Limitation of motion in the shoulder may be present in long standing spasm of the shoulder girdle muscles. Loss of the normal lordotic curve of the neck is present in most cases. Most patients exhibit some limitation of motion, particularly in flexion and extension. Forced hyperextension often produces a sharp radicular pain.

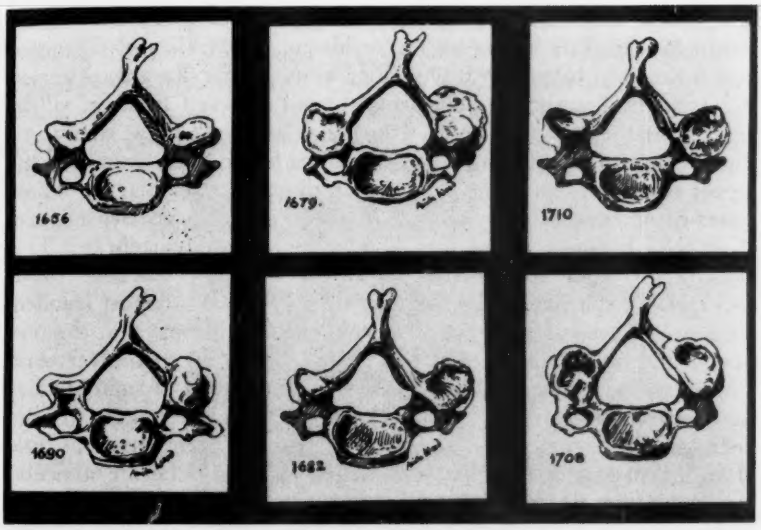

Fig. 2. Drawing from specimens showing marked asymmetry in the articular facets between the second and third cervical vertebrae.

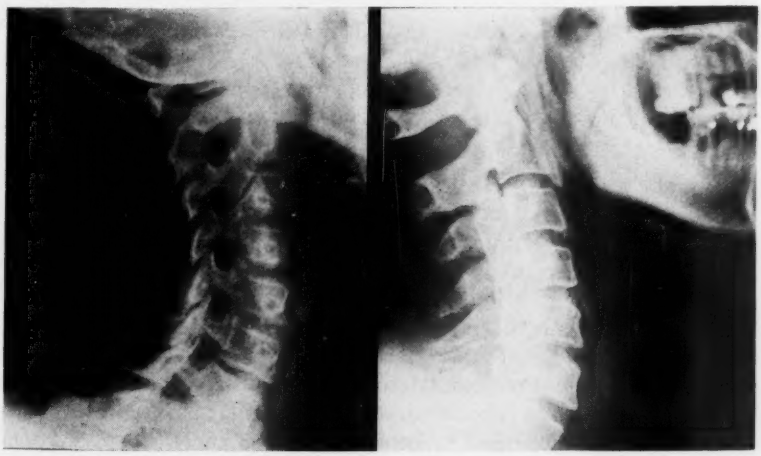

Fig. 3. Unusual plane of the apophyseal joints between the second and third cervical vertebrae which are visible only in the oblique views.

Rarely does one find any objective neurological changes, except in the presence of very large osteophytes or a herniated nucleus pulposus.

A roentgenogram is of the utmost help in arriving at a correct

diagnosis. For these to be adequate, they must include anteroposterior, laterals in flexion, extension and neutral, and right and left posterior oblique positions. The films practically always reveal a loss or diminution of the normal lordotic curve. Flexion will be limited in the involved area. Josey[2] has attached great diagnostic significance to this finding when there is a loss of flexion only in the upper cervical spine in the presence of an occipital headache. These cases often reveal an asymmetry of the articular processes (figures 2 and 3) between the second and third cervical vertebrae. This finding is rather common as indicated by its presence in 18 of our cadaver specimens. Degenerative changes are the most frequent findings. These are demonstrated by osteophytic spurs on the posterior and lateral surfaces of the articular margins of the vertebral bodies and articular facet margins. They are often of sufficient size to encroach on the intervertebral foramina. These changes are not infrequently accompanied by narrowing of the intervertebral disk. This narrowing may allow subluxation of the superior articular process and further encroachment on the foramen. Some authors[5,6] have felt that the narrowing is indicative of a herniated nucleus pulposus. Morton[3] found 11 narrow intervertebral disks and only one herniated nucleus pulposus in his study of 20 cadaver specimens. We found only one herniation (central) in 36 cadaver specimens (Table II). These studies are substantiated by the findings in a series of 186 cases, as shown in Table I. The findings indicate that a herniated nucleus pulposus does not necessarily accompany a narrowing of the intervertebral disk.

The differential diagnosis of cervical radicular pain does not present many problems. Headaches of cervical origin can be differentiated from migraine of true cerebral origin by the localized nerve root tenderness, reduplication of the pain by pressure over the tender nerve and by the x-ray findings. The degenerative arthritic group will present a long-standing history in older persons. The pain will usually involve several segments, and is often bilateral. Objective neurological findings will be absent even in the presence of marked nerve root constriction (fig. 4). A herniated nucleus pulposus presents a rather severe pain localized to a single segment. This will be accompanied by some muscle weakness, decreased sensation, and reflex changes. The findings in the scalenus anticus syndrome are primarily neurovascular, although pain may occasionally be referred to the ring and little finger. For this reason the symptoms are usually diffuse and are aggravated by working with the arm elevated. The Adson test should be positive in all cases.

Conservative methods of treatment have been the ones of choice for us. The regime to be followed will vary in each case. The mild

cases will respond to daily heat, massage, and head stretching, together with good sleeping posture. The latter is accomplished by sleeping with the head in a neutral position. Jackson's contour pillow has been used with good results. We have found that diathermy given concurrently with the head traction is followed by

Fig. 4. Marked constriction of the intervertebral foramina by osteophytes without objective neurological findings.

much more rapid progress. The severe cases will receive temporary relief from novocain injections into the involved nerve root. Our results have been much better with the intravenous injection of 100 cubic centimeters of 2 per cent Tolserol in saline. This will be followed by complete relief that will be continued when combined with complete bed rest, traction, and heat. This routine is continued until all symptoms have subsided, and then it may be necessary to use a cervical collar for a period. It is necessary to instruct these patients that their cervical spines are not normal and that special care is required to prevent severe recurrences. The recurrent cases have responded best to x-ray therapy. In fact, this treatment has given the most permanent relief in all cases in which degenerative changes were present.

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THE TREATMENT OF EXTENSIVE BURNS

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THE pathologic physiology of extensive burns is now well enough established so that the mechanisms which will come into play can be accurately predicted from the moment the patient is first seen. Treatment, therefore, can be directed to the correction of this disturbed physiology, and complications actually prevented in many instances. Treatment based on anticipation of events will be stressed in discussing the periods of shock, toxemia, and healing.

PERIOD OF SHOCK

This phase roughly covers the first 48 hours or more following the injury and is the most critical as far as life is concerned. The bodily response to thermal trauma consists of capillary dilatation; transudation of plasma into the tissues; loss of plasma from the burned surfaces; stagnation of blood in the capillaries and sludging; an increased flow of lymph from the area; mobilization of extracellular fluid, protein, and electrolytes from the uninvolved body tissues; loss of potassium from injured tissues[1]; and the alarm reaction[2] with overactivity of the adrenal cortex and increased metabolism. In some cases hemolysis occurs. All of these processes cause a rapid decrease in the blood volume; a decrease in the circulating red blood cell mass, plasma proteins, and electrolytes; hemoconcentration; edema of the involved tissues; and a loss of extracellular fluid from the uninvolved tissues.[3] The clinical result of these mechanisms is burn shock, the degree depending upon the extent, the type, and the depth of the burns, and the measures taken to prevent it.

Restoration of blood volume and extracellular fluids. When the patient is first seen, an estimate of the per cent of body surface involved by deep burns should be made. This will provide a rough index of the amount of blood or plasma which will be required during the first 24 hour period until laboratory determinations are made. According to Harkins,[4] 1000 cc. is given for each 10 per cent of body surface involved. Hematocrit readings do not reveal hemoconcentration for from three to six hours after the injury. After this period, they should be made frequently to estimate the amount of plasma necessary for replacement. For each point the hematocrit exceeds the normal of 45, 100 cc. is given.[5] The primary goal, however, is to restore or maintain the blood pressure above

Presented during Washington Assembly of The Southeastern Surgical Congress, Washington, D. C., March 6-9, 1950.

the critical level of shock immediately, using any amount of blood or plasma infused as rapidly as necessary, to restore the blood volume. Usually about one half of the calculated required amount for 24 hours is given during the first 8 hours.

The trend is to give more blood earlier rather than to rely upon plasma alone to combat shock. Excessive hemoconcentration does not occur providing sufficient salt solution is also given.[6] Whole blood is needed to restore the circulating red blood cell volume as well as the plasma volume. It restores any destruction of red blood cells which has already occurred, increases resistance to infection, and aids in preventing hypoproteinemia and the anemia which invariably becomes evident from the third day far into the recovery period. Furthermore, blood is cheaper than irradiated plasma. It has been our practice recently to give equal amounts of blood and irradiated plasma during the shock period.

In addition to circulating plasma and red cell volume, water and electrolytes are needed to restore the extracellular fluid which has literally been shifted from uninjured to the injured tissues.[3] These are given by mouth as tolerated and supplemented by parenteral administration as necessary. Roughly, they should equal the amount of blood and plasma given over the 24-hour period. Moyer[3] recommends a mixture of 3 Gm. of sodium chloride and 1.5 Gm. of sodium bicarbonate per liter of water for oral use. Water alone dilutes the body salts, while normal saline by mouth is nauseating and tends to produce acidosis. To restore the extracellular fluid and electrolytes in the presence of impaired renal function, Coller[7] has shown that normal saline is best given half strength and buffered with sodium lactate, as in Hartmann's solution. This latter solution is given parenterally in place of normal saline. Glucose is added in 5 per cent concentration to combat ketosis.

The fluid balance should be adjusted so as to provide at least 1500 cc. daily urinary output during the period of shock. Inserting an indwelling catheter as suggested by Cope[8] and giving sufficient blood, plasma, and fluids as described to produce an hourly output of from 50 to 100 cc. is an excellent method to aid in regulating the fluid balance. The total 24-hour intake should not exceed 10 per cent of the body weight. Care must be exercised not to produce pulmonary edema, water intoxication, and not to give an excess of sodium chloride, especially in cases of the aged and in cases of traumatic anuria. The discrepancy between the intake and output, allowing for ordinary insensible fluid loss, represents the edema of the injured tissues, the loss from the burned surfaces, and the edema of normal tissues, if the patient has been over-hydrated. A large patient with 50 per cent of the body surface involved by deep burns

might require 2500 cc. of blood, 2500 cc. of plasma, and 5000 cc. of fluid by mouth and vein, the first 24 hours. In 1 such case we gave 12,000 cc. daily during the shock period without occurrence of the complications mentioned.

Medications. Morphine is best given intravenously initially to these patients unless shock is so profound as to make its use dangerous. Intravenous morphine is more rapidly effective and obviates the cumulative effect of the delayed absorption of several subcutaneous injections after adequate circulation is restored. Simple debridement can also be carried out with no other analgesic.

Tetanus antitoxin or toxoid should be given routinely in extensive burns although tetanus rarely occurs. Anti-gas serum is given if the burns are in the neighborhood of the anus.

Crystalline penicillin G in doses of 100,000 units every three hours or the combined procaine and crystalline penicillin in doses of 400,000 units every 12 hours should be started immediately as prophylaxis against invasive infection.

The experimental work of Cope et al[9] indicates that adrenal cortical extract (desoxy-corticosterone) and posterior pituitary extract probably have no value in decreasing capillary permeability nor in favorably altering the metabolism in burn shock. The reverse may prove to be true with the use of cortisone and ACTH. Habelmann[10] believes that parathormone combats capillary permeability and edema of the tissues. Testosterone has proved of no value in favorably influencing the metabolism in the early stages[11] but may be of value, especially as regards nitrogen balance, in the later stages.[12] The value of heparin is undergoing clinical investigation.

Oxygen. The use of oxygen is indicated to combat the anoxia in those cases which are complicated by pulmonary edema.

The local treatment and prevention of infection. Consideration of the local treatment is secondary to shock therapy, but definite measures must be taken to prevent contamination, such as covering the burned areas with sterile towels if the local treatment is delayed or deferred. A strict aseptic technic as emphasized by Koch[13] at the time of the primary dressing can not be overemphasized, as the attendants are invariably responsible for infecting these wounds. There is a vast difference between the clinical course of patients whose burns become infected and those whose burns do not, as reflected in the period of disability and in the mortality rate.

The only objectives of local treatment are to prevent infection, allay pain, and diminish plasma loss. A thorough debridement is

not necessary unless the burns are grossly contaminated by dirt, gravel, or grease which are sometimes ground into the wounds. Under the latter conditions, a light anesthesia is necessary but debridement even in these cases should be deferred in case of serious shock. Ordinarily, the areas may be gently cleansed with a bland soap, sterile water, cotton pledgets, and thoroughly flushed with warm sterile normal saline under the effect of intravenous morphine and under the same aseptic methods as carried out in the operating room. Any obviously necrotic loose tissue may be excised. Blebs are not necessarily excised nor opened because of the possible danger of opening avenues of infection. The type of medication applied to the burned surfaces is unimportant as long as it is sterile and not damaging to the tissues. Fine mesh gauze should be used. An occlusive pressure dressing is applied to the extremities starting distally. Pressure lessens edema and plasma loss, relieves pain, obliterates dead spaces, and immobilizes the part. Pressure dressings only partially prevent the escape of plasma into the interstitial spaces[8] and the seepage from the wound itself. These dressings are left undisturbed for from 10 to 14 days unless there is definite evidence of infection, in which case open drainage is resorted to.

It has been our practice to keep the face, neck, and genitalia covered with penicillin ointment or sterile vaseline, believing that this is more comfortable for the patient and simplifies care. After several days, hot moist dressings are used to clean up these particular areas.

Period of Toxemia

Following the period of shock, the extensively burned patient enters a phase known as the period of toxemia which roughly covers the third through the tenth day after injury. Depending upon the extent of the burns, how well treatment has been anticipated, and the corrective measures taken, a combination of the following mechanisms are in effect:

1. Sepsis produces fever and anemia.

2. The edema fluid is resorbed into the blood stream via the lymphatics.[14] This may lead to hemodilution and thus give a false picture of anemia.[15]

3. The wounds still exude plasma. This causes hemoconcentration and loss of protein, electrolytes, and fluid from the body.

4. The renal function is still disturbed with possible retention of nitrogenous waste products and acid metabolites.

5. Hepatic function may be impaired.

6. Autolysis of damaged and necrotic tissue takes place with absorption and excretion of nitrogen.

7. Delayed hemolysis produces anemia.

8. Because of anorexia and disturbed gastrointestinal function, the food intake is low, and this contributes to the anemia, vitamin deficiency, dehydration, and protein deficiency. Weight loss becomes marked.

9. The alarm reaction is still operating with an increased metabolism and increased nitrogen excretion in the urine.

10. The capillary bed begins to expand and early healing is under way.

Laboratory studies. Urinalyses; blood counts; hematocrit readings; non-protein nitrogen, carbon dioxide combining power, plasma chloride, and serum protein determinations should be made every other day during this period as indicated. Blood volume measurements are of course very useful if facilities are available. The therapy is guided by these various determinations and by the condition of the patient.

Nutrition. Usually by this time the patients are able to eat and drink to a varying degree, and the intravenous therapy becomes supplemental. Plain water is now given instead of the saline-bicarbonate mixture. Adequate feeding is tremendously important for proper recovery and tissue regeneration. Giving 1000 calories in excess of the normal daily requirement[3] is an ideal to be strived for in maintaining nutrition. One hundred and fifty to even 400 Gm. of protein may be necessary to maintain the patient in positive nitrogen balance. Adequate carbohydrates (350 Gm.) help prevent ketosis and protect the liver. Average daily vitamin requirements[5,16] in extensive burns are:

Vitamin A	20,000 units
Thiamine hydrochloride	20 to 50 mg.
Riboflavine	20 mg.
Nicotinic acid	150 to 250 mg.
Ascorbic acid	1,000 mg.
Vitamin D	2,000 units
Vitamin K	1 mg.

Sulfur, sodium chloride, potassium and calcium are also necessary. Extra milk, meat, fish, eggs along with protein hydrolysate or amino acid mixtures, multiple vitamin capsules, and iron tablets help replenish these deficits. In some cases, tube feeding may be necessary.

Repeated blood transfusions, with due regard to the Rh factor, are necessary to correct anemia and help correct hypoproteinemia. Plasma may be given in the presence of hemoconcentration and hypoproteinemia. Oral feedings to restore plasma proteins are always best and more effective. Enteric coated salt tablets and intravenous normal saline should be used to correct chloride deficiency during this period. The serum protein and chloride levels are difficult to restore once they are allowed to become low.

Fluid balance. The intake during the period of toxemia is governed chiefly by carefully observing the urinary output, in addition to providing for the usual insensible loss and the loss of fluid from the wounds. When edema begins to subside and kidney function improves, the urinary output of some of these patients almost approximates their intake. In such cases, dehydration and salt depletion must be guarded against. On the other hand, large volumes of electrolytic solution, especially in the presence of a low plasma protein, may overhydrate the patient. Ordinarily, fluids sufficient to maintain a 1500 cc. output are all that is necessary. An intake of 3000 to 4000 cc. is probably the average daily requirement in this phase.[5]

Medications. The use of penicillin is continued during this period. Sulfonamides are not necessary and may impair renal function.

Ambulation. Early ambulation, if feasible, improves function, appetite, and morale.

The Period of Healing

This phase includes roughly that period from the tenth day until the patient is completely covered by skin. It is a continuation of the preceding one as regards pathologic physiology, but the body is more stabilized and healing is more apparent. Healing proceeds by separation of the slough, granulation, and epithelization.[3] There is a loss of red blood cells, sodium, potassium, calcium, and protein from the granulating areas.

Death may still occur from sepsis and debilitation. Attention to blood chemical changes and nutrition is still much in order. The general measures of treatment are continued. More attention, however, is now focused upon the wounds. Scarring and contracture is anticipated and prevented by closing the wounds by skin grafts as soon as possible. When this is accomplished, fluid and chemical balance is automatically restored, suffering is at an end, and the patient rapidly returns to a normal state.

Treatment of burned areas. This is based upon the established

principles of treating other wounds and depends upon the depth of the burn and whether or not infection is present.

For reasons of classification, it is convenient to divide second degree burns into superficial and deep types. Clinically, an uninfected superficial second degree burn heals in about two weeks. A deep second degree burn in which a few deep epithelial elements remain and a third degree burn in which no epithelial elements remain are impossible to differentiate at the time of the original dressing and difficult to differentiate even after two weeks. The former will heal and not require a graft unless infection supervenes, while the latter can only heal by an ingrowth of epithelium from the periphery of the wound and should be grafted.

Infection. The local management during the healing period depends upon whether or not the areas are infected. Infection may develop at any time during any period. With the routine use of antibiotics, invasive infection is a rarity, but local infection still occurs. The incidence of infection increases in direct proportion to the depth of tissue destruction. The infection is invariably produced by a mixed growth of bacteria. Open drainage is the only treatment for infected burns. The application of vaseline gauze or any greasy ointments tends to seal in pus and prevent drainage. The most effective treatment is the continuous application of warm moist saline dressings. These promote drainage and increase the blood supply to the part. In an old neglected case when the eschar is undermined with pus, it should be excised before the moist dressings are started.

The local application of antiseptics, sulfonamides, and even antibiotics thus far, has been of only slight value. Furacin and boric acid seem to be effective in the local treatment of pyocyaneus infection which is often troublesome. Boric acid should not be applied to large areas, however, because of possible toxic effects.[3]

The local application of heat and moisture, the parenteral use of penicillin, and the individual's own acquired immunity usually make it possible to start skin grafting of burns complicated by infection three to five weeks from the time of the injury. If infection is not controlled, cultures and sensitivity tests are made and any chemotherapeutic agent found to be specific for the organisms is given systemically and perhaps applied locally. The general appearance of the wound and the amount of discharge are of more value in determining the optimum time for grafting than cultural studies.

When joint surfaces are involved by infected granulations, supervised daily exercises in a whirlpool bath in conjunction with moist

packs preparatory to grafting are of tremendous value in restoration of function. When the hand is involved by deep burns, with or *without* infection, we routinely remove the pressure dressing in one week and start whirlpool baths and moist dressings. The improved functional results are gratifying.

Debridement. When pathogenic infection does not occur, the objective is still to remove the slough so that grafts may be applied to the third degree areas at the earliest possible time. This may be accomplished by several methods:

1. *Gradual debridement:* This method utilizes moist dressings, whirlpool baths, and gradual excision of the eschar as it becomes loosened. It requires more time and more nursing care. It is used routinely with infected burns but carries the danger of infecting the cleaner cases.

2. *Pyruvic acid:* This method developed by Harvey[17] produces separation of the slough through dissolution by the application of a 1 per cent pyruvic acid starch paste. It may take six to eight days but requires no operation. We have had no experience with this method.

3. *Excision and immediate grafting:* This is the method used by Cope.[18] The original dressing is removed in 10 to 14 days, all areas of slough are excised, and skin grafts are applied, all in one operation. The only disadvantages are in differentiating deep second degree areas from areas of full thickness loss, excessive bleeding, and the problem of complete hemostasis in the graft beds.

4. *Excision and delayed grafting:* This is the method employed by Allen.[19] The wound is inspected and dressed on the tenth day. Under anesthesia, the following day, debridement is carried out and pressure dressings are applied. Several days later, skin grafts are applied. This requires two operations but accomplishes closure in 14 to 16 days after injury.

All four of these methods are effective. The last three accomplish very early coverage of the denuded areas. This is the prime objective after recovery from the acute phases of the burn. The area of debridement is often greater than can be grafted safely at one operation.

Skin grafting. If the wounds are healthy, the blood chemistry normal, nutrition restored, and anemia corrected, there is never any doubt regarding the success of a split thickness skin graft. The longer grafting is delayed, the more granulation, scarring, and contracture will occur.

When the wound is ready for a skin graft, a pressure dressing of

fine mesh furacin gauze applied preoperatively has been very satisfactory. The split graft cut at .015 inch by the Padgett dermatome has proved from experience to be ideal for resurfacing all areas. After healing is complete, these may be replaced by three-quarter or full thickness grafts in such areas as the hands or face, if necessary, for functional or cosmetic reasons.

Conclusions

With the increasing knowledge of the pathologic physiology of burns, the general principles of anticipated treatment outlined are becoming more nearly standardized. By controlling shock, infection, fluid balance, nutrition, and de-emphasizing local medications, many more lives are being saved. With modern technics, skin grafting has become easier, more widely used, and, in experienced hands, very successful. Early skin grafting has reduced debilitation from chronic open wounds, and functional disability from scar contractures to a new minimum.

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THE AMERICAN SURGEON

Formerly
THE SOUTHERN SURGEON
Official Publication of
THE SOUTHEASTERN SURGICAL CONGRESS
THE SOUTHWESTERN SURGICAL CONGRESS

Published Monthly by
The AMERICAN SURGEON PUBLISHING COMPANY
701 Hurt Building
ATLANTA 3

Subscription in the United States, $8.00

Volume XVII | April, 1951 | Number 4

MULTIPLE SCARS

One of the most difficult problems facing surgeons today is the differentiation between those patients whose symptoms are based on organic pathology and those whose complaints are functional in character. This latter type of patient seems to be on the increase as hospitalization insurance becomes more readily obtainable and as a result of the present socialistic government propaganda. That psychogenic factors play a great part in many surgical procedures has been repeatedly emphasized in surgical and psychosomatic writings. As the psychogenic factor and the physical component of each disease varies with the individual, so does the surgeon's ability to make an accurate diagnosis. Eliminating functional from organic symptoms frequently taxes the ingeunity of the most experienced and conscientious surgeon.

What then are some of the signs and symptoms which make the surgeon suspect a strong psychogenic factor in the illness he is concerned with? According to Hart, the differences the patient demonstrates in his attitudes, free association and in specific behavior should give a clue to the surgical necessity. Jacobsen lists these as

vagueness and evasiveness, procrastination in seeking medical attention, broken appointments, self-treatment, sabotage of treatment, medical shopping, patronage of cults, complacency, relief afforded by physical defects, fear of personality study, denial of conflicts, misleading explanations and acceptance of previous ineffective remedies, multiplicity of subjective symptoms but few objective findings, and a history of multiple surgical procedures.

One could easily say concerning this latter sign that a wise surgeon could profit by the mistakes of others. Certainly multiple scars on a patient's abdomen should be a warning sign to any clear thinking surgeon. There is nothing more disturbing than to see a patient with four or five separate and distinct abdominal scars and to check back over the various hospital records and find a noticeable lack of organic pathology. To make separate scars over the abdomen is bad enough in itself, but failure to realize that the patient's disease is psychogenic is a travesty.

Meminger has questioned the unconscious motives of the surgeon, accusing the surgeon of giving vent to sadistic impulses. The problem, however, is not so simple. Every surgeon from time to time sees patients who have had numerous surgical procedures in whom true organic disease is found at operation to explain the patient's continued symptoms. Each new patient, then, presents a challenge to the surgeon's ego. Frequently his ego is stimulated by the pathologist, the internist, or the psychiatrist. In place of egotism the surgeon should develop his empathy.

Every surgeon must be his own psychiatrist if he hopes to avoid unnecessary surgery on psychoneurotic patients. Careful history taking will obviate many unnecessary operations. Modern methods of diagnosis should be used to the fullest extent to prove the presence or absence of organic disease. The patient's domestic and emotional life should be evaluated as well as his blood and urine. Not all of the responsibility for unnecessary operations, however, lies with members of the medical profession. Most of the scarred psychoneurotic patients are demanding and aggressive in desiring surgical treatment. Surgery for these patients becomes an escape from an intolerable environment and at the same time is a means of securing attention, affection and security. The fact remains that surgery in this familiar type of patient is poor psychiatric therapy. Each surgical procedure represents another factor in the ultimate incurable invalidism.

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BOOK REVIEWS

The Editors of THE AMERICAN SURGEON *will at all times welcome new books in the field of surgery and will acknowledge their receipt in these pages. The editors do not, however, agree to review all books that have been submitted without solicitation.*

ATLAS OF HISTORICAL DIAGNOSIS IN SURGICAL PATHOLOGY. By CARL T. NEUBUERGER, M.D., Professor of Pathology, University of Colorado School of Medicine, Denver Col., with a section on Exfoliative Cytology by Walter P. Wikle, M.D., Asst. Professor of Pathology, University of Colorado, Denver, Col. Photography by Glenn E. Mill, M.A. Baltimore, Md.: William and Wilkins Co., 1951, 460 pages, $11.00.

This atlas of Histopathology is a unique addition to armamentarium of the surgeon-pathologist. The volume was incorporated with the idea that some atlas is needed badly which would be of use by medical students, internes and residents, as well as candidates for certification by the Boards in learning histopathological diagnosis. The binding is sturdy, the paper is excellent and the impression very good. The volume consists of multiple microphotographs, all in black and white, besides containing a brief legend explaining the salient features to be noted. These microphotographs seem to be well chosen and to be representative of the various pathological conditions presented. These conditions vary considerably in type; in fact, little can be desired in the matter of variety. Only a few of the rare conditions are omitted. In the many instances there are two microphotographs for the same condition, one under higher power than the other. Legends for the most part are quite timely and point out the important differential and typical characteristics of the various lesions.

There is included a section of exfoliative cytology which is a great help in the examination of the various body fluids. These microphotographs seem to be very representative and well chosen.

The volume could be greatly improved by having the microphotographs in full color which, of course, would increase the cost of printing, yet would add immensely to the ease and understanding of the sections. This is due to our being accustomed to seeing various tissue in different hues and colors rather than in the shades of gray. To understand the shades of gray requires considerable practice. All in all the volume is quite worthwhile and will find a welcome place in the library of the teaching hospital as well as the surgical-pathologist.

A. H. LETTON, M.D.

RESULTS FROM THE TREATMENT OF SCIATICA DUE TO LUMBAR DISK PROTRUSION. Paul H. Harmon. *The American Journal of Surgery 80*:829-840 (Dec.) 1950.

The statistics of this paper are based upon 1,500 hospital cases during the past eight years and the author's personal study of 580 of this entire group. The results of the operated cases of the first five years in which spinal fusion was not performed were inferior to those of the past thirty months where fusion was done more frequently. In this latter period every patient was given conservative treatment consisting of bilateral leg traction with bed rest on a firm mattress, adequate sedation, massage and local heat in one form or another. In addition, injections of curare were utilized, some patients had leg and back manipulations under anesthesia and many patients received some form of back support.

Patients with x-ray or clinical evidence of instability, including those with recurring attacks of pain relieved by bed rest, were subjected to spinal fusion. Patients with intractable sciatica which did not respond to conservative measures were subjected to myelography. If a protruded disk was diagnosed, excision of one or both of the lower two lumbar intervertebral disks was performed through an anterior transabdominal extraperitoneal approach and the disk space filled with cortical bone grafts cut to size.

The incidence of surgical attack of all types in the entire group of 1,500 cases was 10.3 per cent.

Failure of relief from low back pain was commonly encountered in patients who had Workmen's Compensation status.

Complete relief from sciatica was obtained in all 30 patients in whom subtotal excision of one or both of the two lower lumbar intervertebral disks was carried out by the anterior approach. Relief from low back pain was observed in 90 per cent of the same patients.

Posterior spinal fusion of the fourth and fifth lumbar segments to the sacrum also gave relief from both sciatica and low back pain in patients with these complaints who had suffered repeated and recurrent attacks over a number of years but who were relieved temporarily by recumbency prior to operation.

An interesting discussion of the paper at the time of presentation follows the article in which divergent points of view concerning the subject matter were thoroughly covered.

R. F. M.

NOTICE

The American Goiter Association will meet in Columbus, Ohio, May 24, 25, 26, 1951, in the Deshler-Wallick Hotel. The program for the three-day meeting will consist of papers dealing with goiter and other diseases of the thyroid gland, dry clinics and demonstrations.

ABSTRACTS FROM CURRENT LITERATURE

ROENTGEN THERAPY FOR PRURITIS ANI. Wilbur Ball. *The American Journal of Proctology 1:*123-129 (Sept.) 1950.

In contradiction to the usual view that x-ray therapy for anal pruritis should be used only after other treatments have failed, Ball has compiled a list of 100 cases in which it was the first treatment employed and in most instances the only form of therapy used. Of the 100 cases, 8 were lost to follow up. The remaining 92 are presented according to results: Complete relief, 43; partial relief, 35; failure, 14. The x-ray machine delivered 140 KVP. Though the filtration employed is not given, it is stated that the "x-rays were of the 'hard' penetrating type."

The usual plan of treatment consisted of weekly doses for four weeks of 140 to 160 R-units each. Therapy was often discontinued when symptomatic relief occurred. The fewest number of treatments was one and the greatest 18. Dark-skinned patients were given more than light-skinned ones.

The importance of wide retraction of the buttocks to produce eversion of the anus during treatment is emphasized.

Of the total of 92 patients, the etiology of the pruritis was determined in only 2 instances, the others being considered idiopathic.

The author concludes that "x-ray therapy is definitely indicated in pruritis ani."

R. H. S.

THE PRESENT STATE OF SURGERY IN THE TREATMENT OF HYPERTHYROIDISM. Edward S. Judd. *The Journal-Lancet 70:*429-432 (Nov.) 1950.

Surgeons would be the first to concede that medical therapy of hyperthyroidism would be highly preferable if an agent were available which could be safely and successfully employed. With the introduction of the goitrogens, the wave of enthusiasm accompanying the hope that they would replace surgery was short lived and there remains a very large place for the surgical treatment of hyperthyroidism.

Judd considers the two main types of hyperthyroidism separately. Black has previously (1946) analyzed the results of treatment of exophthalmic goiter at the Mayo clinic and concluded that surgery was indicated in about 97 per cent, the remaining 2 or 3 per cent representing patients with severe heart disease, etc., complicating the hyperthyroidism and contraindicating surgery. With the exception of one year (1938) when the mortality rate reached 1.8 per cent, the mortality rate was below 1 per cent. In the last year covered by his report(1945), the mortality rate was only 0.3 per cent. Judd's study takes up where Black's left off. During the past four years, 772 patients with exophthalmic goiter were treated with thyroidectomy and there were no deaths in this group.

In regard to the use of radioactive iodine, Judd is in agreement with others feeling that the use of the element is simple and effective but that the uncertainty of its effect on other tissues and the possibility of carcinogenic action preclude its use in younger patients.

Recent refinement in goitrogens has stimulated further investigation but the

basic disadvantages of this form of treatment (toxic reactions, frequent recurrence after withdrawal, and necessity for prolonged observation) remain.

Now, more than ever, the conviction is firm that the treatment of nodular goiter, whether single or multiple, is surgical. Of 605 patients with toxic, nodular goiter treated surgically in the four year period covered by this report, two (0.33 per cent) died, one of cardiac failure and one of postoperative crisis. Of 1453 patients receiving surgical treatment for nontoxic adenomatous goiter, one (0.06 per cent) died. Thus in the four year period covered by this report (1946-49) 2,830 patients had thyroidectomies at the Mayo clinic and of this number there were only 3 deaths, giving an over-all mortality rate of slightly over 0.1 per cent.

Judd concludes that this low mortality figure is attributable to proper preparation of the patient with Lugol's solution and the judicious addition of goitrogens in a few instances together with the ability of the internist to select those very few patients who would not tolerate subtotal thyroidectomy.

R. H. S.

SIGNIFICANCE OF TUMORS OF THE NECK. Charles W. Mayo and Madison J. Lee. *The Journal-Lancet 70*:420-428 (Nov.) 1950.

The present report covers an analysis of the cases in which cervical conditions were treated surgically at the Mayo clinic during 1949. All patients with lesions of the neck were included except those with superficial skin lesions, tumors of the thyroid and conditions of the larynx, esophagus and great vessels. Of a total of 609 cases, 304 were malignant conditions, 305 were benign tumors including 110 inflammatory lesions. The correct diagnosis was suggested preoperatively in 413 instances (67.8 per cent). In 330 instances, cervical lymph nodes were the site of the disease. Tumors of the neck was the primary complaint of the patient in only 167 (54.9 per cent) of these patients.

The author's conclusions are quoted:

"The presence of a cervical tumor is the primary concern of many patients. A careful and systematic diagnostic study should be employed in all cases of cervical swelling. The seriousness of the presence of a tumor of the neck is emphasized by the fact that in our group of surgical cases, 50 per cent of the lesions were malignant.

"Benign tumors are excised to eradicate a site of actual or potential infection, for cosmetic reasons at the patient's request, or because of the inability to differentiate them from a malignant lesion.

"Adenocarcinoma of the parotid salivary gland, which comprises most of the primary malignant tumors of the neck, is so situated that it is relatively amenable to diagnosis.

"A clinical diagnosis of lymphoblastoma should be confirmed by biopsy. An accurate pathologic diagnosis should be made before treatment with roentgen therapy, cortisone, ACTH or other drugs, in order to evaluate the response properly.

"From the aspects of prognosis and treatment, the most important problem in the majority of cases is whether the swelling is a lymph node, and if so, what is the nature of the lymphadenopathy. Fortunately, from a diagnostic standpoint, in most cases of acute inflammatory lymphadenopathy there are a

sudden onset, local or systemic manifestations of the causative conditions, and subsidence of the condition on conservative treatment.

"Specific inflammatory lesions of cervical lymph nodes, such as tuberculosis and Boeck's sarcoid, should undergo pathologic and bacteriologic studies in order that they may be properly treated.

"As emphasized by others and borne out in our study, metastatic carcinoma is the commonest cause of chronic lymphadenopathy in adults. Especially is this true when there is unilateral enlargement of cervical nodes. Because of the difficulty in making a clinical diagnosis, biopsy should be performed in all cases of persistent cervical lymphadenopathy, after careful search for a primary lesion.

"With the appearance of the theory of embolic spread through lymphatics, carcinoma that is metastatic to cervical nodes from a primary lesion in the head or neck often is amenable to treatment. It is not within the scope of this survey to present the controversial views on handling these lesions. A recent publication by Judd and Beahrs presents the opinion of the clinic in the management of epithelioma of the lip, and similar management of intra-oral lesions is indicated. Paramount in directing treatment is the inability to determine clinically whether metastasis is present, with or without enlarged nodes is brought out in this survey.

"Metastasis to Virchow's node can result from the presence of almost any carcinoma, and this is well illustrated in our survey. From the standpoint of operability and prognosis, it is important to diagnose cervical metastatic tumors that have come from a primary lesion below the clavicles.

"If biopsy is indicated for diagnosis, the diagnosis studies should be complete. Except in cases of dissection of the lymph nodes in the presence of a primary carcinoma elsewhere, when the pathologist does not give an unequivocal report of neoplasm, a full bacteriologic study of a portion of the tissue, according to the plan given, should be initiated."

Analytical tables covering the study are included.

R. H. S.

INTESTINAL OBSTRUCTION. Warren H. Cole. *California Medicine 73*:384-390 (Nov.) 1950.

Intestinal obstruction remains a serious disease with a high mortality rate despite improvements in knowledge of the pathologic physiology concerned, more effective antibiotics and the introduction of gastrointestinal decompression. Though the diagnosis may sometimes be obscure, it can usually be made with a fair degree of accuracy by the history alone. Characteristic cramping pain is fairly constant. Distension is present in low lesions but absent in high lesions. On the contrary vomiting is prominent in high lesions and minimal in low lesions. Increased peristaltic sounds as noted on auscultation are very helpful in making the diagnosis. They are absent in paralytic ileus. Visible peristaltic waves are almost pathognomonic of intestinal obstruction.

According to Cole, intestinal obstruction of the type due to adhesions can be relieved by gastrointestinal decompression in 80 to 90 per cent of the instances. He feels that operation is indicated a short time after relief because of the likelihood of recurrence. In practically all the other types of obstruction, decompression is indicated only while the patient is being prepared for opera-

tion. Strangulation demands early operation and, according to the author, strangulation can usually be diagnosed if it develops while the patient is under observation. Its development is characterized by increase in pain, pulse rate, and muscle spasm.

High obstruction almost always produces dehydration and electrolyte imbalance. As a rule, it is unwise to wait until these deficiencies are corrected before operation is undertaken but correction should be well under way at the time of operation. Though resections are necessary in the case of strangulation, they should be avoided in obstruction when strangulation is not present. Thus resection of obstructing tumors should be delayed and the obstruction relieved by enterostomy or a short circuiting procedure.

Operative technic must be expert and carried out with a minimum of trauma. The importance of postoperative care is also emphasized. Decompression for two or three days following operation, restoration of fluid and electrolyte balance and whole blood transfusion are important features of the postoperative management.

R. H. S.

TUBAL STERILIZATION. Frederick C. Irving. *American Journal of Obstetrics and Gynecology 60:*1101-1111 (Nov.) 1950.

Though the Pomeroy operation for tubal sterilization has offered a definite improvement of results obtainable with the Madlener technic, frequent failures are still being reported. In 1919, Irving first described his method featuring burial of the proximal cut and ligated end of the tube deep into the myometrium. The description of the operation is given again in this communication and the exact technic employed by him is more clearly understandable than it was in the original description.

The author herewith presents an impressive series of 1106 operations for sterilization. His operation was employed in 814 of these without a known failure. The Pomeroy technic was employed in 118 instances. There were two failures in this group giving a failure rate of 1.7 per cent for the Pomeroy operation. The two failures are considered in detail.

An illustration of the ultimate result of the implantation employed in the Irving technic based on a specimen removed by hysterectomy eight years after operation revealed the proximal end or tube to be firmly imbedded in the myometrium and the lumen firmly closed with scar tissue.

In discussion, it was pointed out that troublesome oozing and hemorrhage may be encountered when this technic is employed. Irving replied that in order to make the operation bloodless, the surgeon simply avoids the blood vessels.

R. H. S.

THE INCIDENCE OF MALIGNANCY IN GASTRIC ULCERS BELIEVED PREOPERATIVELY TO BE BENIGN. Elmer Graham Lampert, John M. Waugh, and Malcolm B. Dockerty. *Surgery, Gynecology and Obstetrics 91:*673-679 (Dec.) 1950.

During the five year period from 1938 through 1942, the diagnosis of malignant gastric lesion was made at the Mayo clinic by the surgeon or pathologist at operation in approximately 1400 cases. From this group were

selected 73 cases which represented the instances in which the diagnosis of malignancy had not been made clinically, roentgenographically or gastroscopically. The title of this paper implies that the cases studied would be those believed to be definitely benign but cases are included in which the roentgenologist reported "ulcer, cannot rule out malignant disease."

In the five year period, operations were performed on 550 patients who had been given a preoperative diagnosis of benign ulcerating lesions of the stomach. The 73 found to have malignant disease gives an incidence of 13 per cent. Epigastric pain was the most frequently encountered symptom. The average duration of symptoms prior to admission was almost 38 months and ranged up to 40 years. A number of the patients had experienced a decrease in symptoms during the three month period preceding operation.

More than one fourth of the patients had had one or more hemorrhages sufficient to produce hematemesis or tarry stools. Slightly more than half of the patients had lost 5 lbs. or more in body weight, 22 had noticed no alteration in weight and four were actually gaining weight. In 18 patients (21.9 per cent) duodenal ulcer was associated with the gastric lesion.

In 66 cases the concentration of free hydrochloric acid was determined. In 65 per cent this was within normal limits, in 34 per cent it was below normal limits (21 per cent had no free hydrochloric acid). The concentration of free acid was slightly higher in those cases with an associated duodenal ulcer than in those without duodenal ulcer.

Partial gastric resection was carried out in 60 cases. In the remaining thirteen, biopsy or some other unsatisfactory procedure was done. The resectability rate was 82.2 per cent. Sixty-four patients were operated on soon after admission and the remaining nine had been observed for periods from six weeks to six years prior to operation.

The location of the lesion was on or near the lesser curvature in 87.5 per cent of the cases. Forty-two were diagnosed as simple adenocarcinoma, 22 mucous carcinoma and 8 scirrhous carcinoma. In 1 case the lesion was a lymphosarcoma. Of the 72 cases of adenocarcinoma, the grading (Broders') was as follows: grade 1, 3 cases; grade 2, 17 cases; grade 3 in 18; and grade 4 in 34 cases.

Of the 73 patients, 3 died in the hospital after operation, giving a hospital mortality rate of 4.1 per cent. Of the remaining 70 patients, 33 (47.1 per cent) survived for a period of three or more years. One patient was then lost to follow-up. Of the remaining 69, 30 (43.5 per cent) lived five years or longer.

The authors feel that this group of cases is illustrative of a well defined type of case for which we have no method of diagnosis short of the pathologic examination of the resected tissue and conclude that temporizing with an ulcerating lesion of the stomach introduces a serious risk.

R. H. S.

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The American Surgeon is published monthly. Subscription price in the United States and Canada: $8.00; in the other countries: $9.00, including postage. Single copies, $1.00 postpaid.

Checks may be made payable to The American Surgeon Publishing Company, 701 Hurt Building, Atlanta 3, Georgia.